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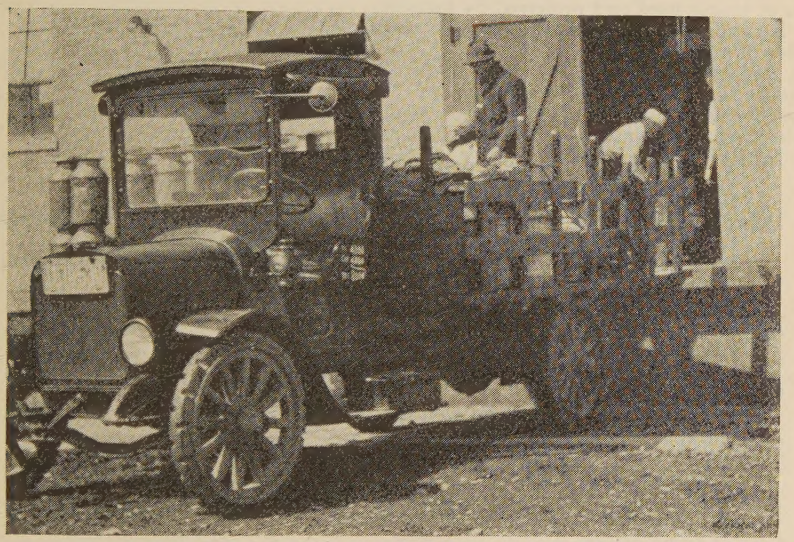
Farm Motor Trucks in New York

V. B. Hart



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FARM MOTOR TRUCKS IN NEW YORK

A THESIS

PRESENTED TO THE FACULTY OF THE GRADUATE SCHOOL OF CORNELL UNIVERSITY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

BY

V. B. HART

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FARM MOTOR TRUCKS IN NEW YORK[1]

V. B. HART

Whenever a new kind of transportation has been developed, attention has first been given to carrying passengers instead of freight. This was true first with the railroads and later with the automobile industry. More than a hundred concerns were making passenger automobiles before the manufacture of trucks was started on a commercial basis.

The construction of the first motor truck in the United States and the development of truck manufacturing from an industry producing less than five hundred machines in 1904 to one that turned out over a third of a million in 1921, has all taken place during the past twenty years. The thirteenth United States census reported 21,692 motor vehicles manufactured in this country in 1904 by establishments engaged in the automobile industry.[2] Of this number, 411 were motor trucks and delivery wagons.

In 1909 automobile manufacturers made 121,868 pleasure and family vehicles and 3228 trucks and delivery cars.[2] Five years later, in 1914, the annual production had risen to 543,679 pleasure and family cars and 23,942 trucks. The 1919 census of manufactures with reference to the automobile industry gives the production of passenger vehicles by automobile manufacturers[3] for that year as 1,557,480, and of trucks and delivery cars as 120,559.

The National Automobile Chamber of Commerce of New York City, from figures furnished by manufacturers, gives the production of passenger cars for 1922 as 2,287,000 and of trucks as 240,000; and the Bureau of Public Roads of the United States Department of Agriculture reported approximately 11,000,000 passenger cars and 1,250,000 trucks registered in this country during 1922.

MOTOR TRUCKS ON FARMS IN THE UNITED STATES

Prior to 1920, there were no complete and reliable sources of information as to the number of motor trucks in use on farms in the United States. Figures collected during that year by the Office of Farm Management and Farm Economics of the United States Department of Agriculture agreed with the common observation that the number of farm trucks had been rapidly increasing during the past five years. Data obtained in connection with a farm motor-truck study made by that office, covering 753 farm trucks scattered thruout New England and the northeastern

[1] Also presented to the Faculty of the Graduate School of Cornell University, June, 1923, as a thesis in partial fulfillment of the requirements for the degree of doctor of philosophy.

AUTHOR'S ACKNOWLEDGMENTS. This thesis is based on investigational work done by the author for the New York State College of Agriculture under the direction of Professor G. F. Warren. It was made possible by the cooperation of the many farmers who willingly furnished the essential data and information used. Acknowledgment is due also to the Bureau of Crop Estimates of the United States Department of Agriculture for assistance in obtaining some of the preliminary data. To these and to many others who gave valuable suggestions and assistance, the author expresses his sincere thanks and appreciation.

[2] Thirteenth Census of the United States, vol. 10, Manufactures (1909), p. 816. 1913.

[3] Fourteenth Census of the United States, vol. 10, Manufactures (1919), p. 874. 1923.

States, showed that 84 per cent of the trucks had been in use for three years or less.[4] Similar data from the results of a study of farm trucks in the Corn Belt States showed that less than one per cent of 831 truck owners included in the investigation had owned their trucks for more than three years.[5]

The fourteenth United States census reported 131,551 farm-truck owners in this country in 1920. Two per cent of the farms had trucks.[6] The percentage of farms having trucks varied from 11.5 per cent and 10.4 per cent in Rhode Island and New Jersey, to less than one per cent in many of the Southern States. The distribution of farm-truck owners in the country by States is shown in figure 1 and the percentage of farmers

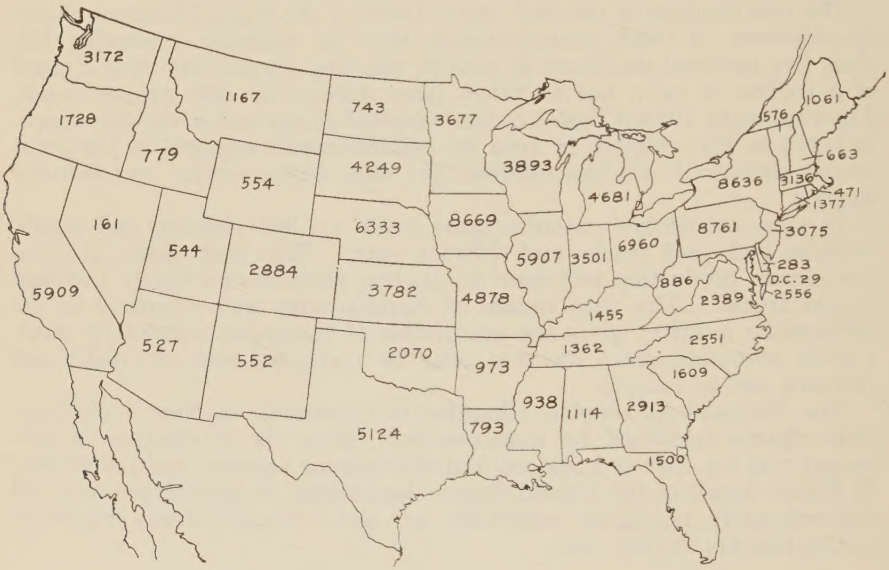

FIGURE 1. NUMBER OF FARM MOTOR-TRUCK OWNERS IN THE VARIOUS STATES, 1920

owning trucks in the different States is shown in figure 2. There were 8636 farm-truck owners reported in New York. This number represented 4.5 per cent of the farms in the State.

Shortage of labor, especially during the World War, and increased costs of maintaining horses and wagons, have probably been the two most important direct factors in increasing the number of trucks on farms. The improvement of state and county highways has been both a cause and an effect of the increase in the number of trucks and automobiles on farms. A good road to market is an added inducement to a farmer to buy a truck, and a truck is an added inducement to him to get the good road. Improvements in the construction of trucks and the standardization of parts,

[4] Experience of eastern farmers with motor trucks. By H. R. Tolley and L. M. Church. U. S. Dept. Agr., Bul. 910, p. 7. 1920.
[5] Corn-Belt farmers' experience with motor trucks. By H. R. Tolley and L. M. Church. U. S. Dept. Agr., Bul. 931, p. 6. 1921.
[6] Fourteenth Census of the United States, vol. 6, Agriculture, part 1 (1919), p. 22. 1922.

together with the establishment, in small towns, of sales and service stations for passenger cars, have given truck manufacturers excellent opportunities for increasing their sales among farmers.

PURPOSE OF THIS INVESTIGATION, AND METHODS OF STUDY

In order to make available to farmers of this State information concerning the experience of those who had used trucks in connection with their farm business, the writer started, in 1921, a study of farm motor trucks on New York farms. The object in making the study was to obtain reliable data on the costs of operating farm trucks, and information as to the possibilities and limitations of trucks for farm use. No attempt

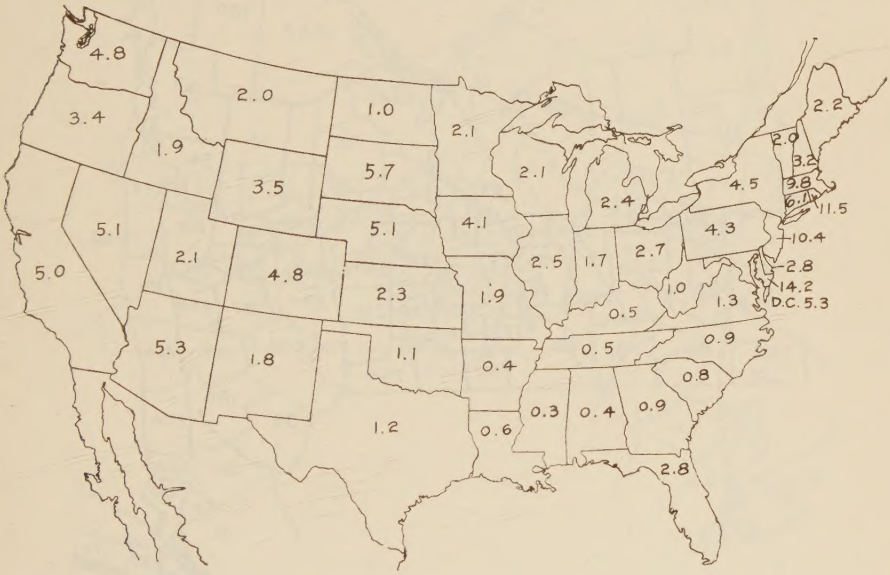

FIGURE 2. PER CENT OF FARMERS OWNING MOTOR TRUCKS IN THE VARIOUS STATES, 1920

(Average for the whole United States, 2 per cent)

was made to prove or to disprove any preconceived opinion as to the efficiency of any particular type or make of truck or the relative values of trucks and horses for farm use.

With the cooperation of the Bureau of Crop Estimates of the United States Department of Agriculture, and the Extension Service of the New York State College of Agriculture, questionnaires asking for names and addresses of farm-truck owners were mailed on June 1, 1921, to all farm bureau committeemen in the State. The 2275 questionnaires which were filled out and returned gave names and addresses of 8417 truck owners.

The questionnaires returned were very evenly distributed over counties containing 94.3 per cent of the farms of the State. Due to loss of mail in transit, complete returns were not obtained from several counties of the State. The Office of Farm Management and Farm Economics of the United States Department of Agriculture ascertained from the crop

reporters of the Bureau of Crop Estimates the number of farm-truck owners in the different counties of the State on January 1, 1920. Reports received by the writer from farm bureau committeemen from all but five of the agricultural counties of the State showed 126 per cent more truck owners on June 1, 1921, than the crop reporters gave for these counties on January 1, 1920.

Assuming that the number of truck owners in the small areas not fully covered by the questionnaires increased at the same rate as in the rest of the State, there would have been 9317 farm-truck owners in New York

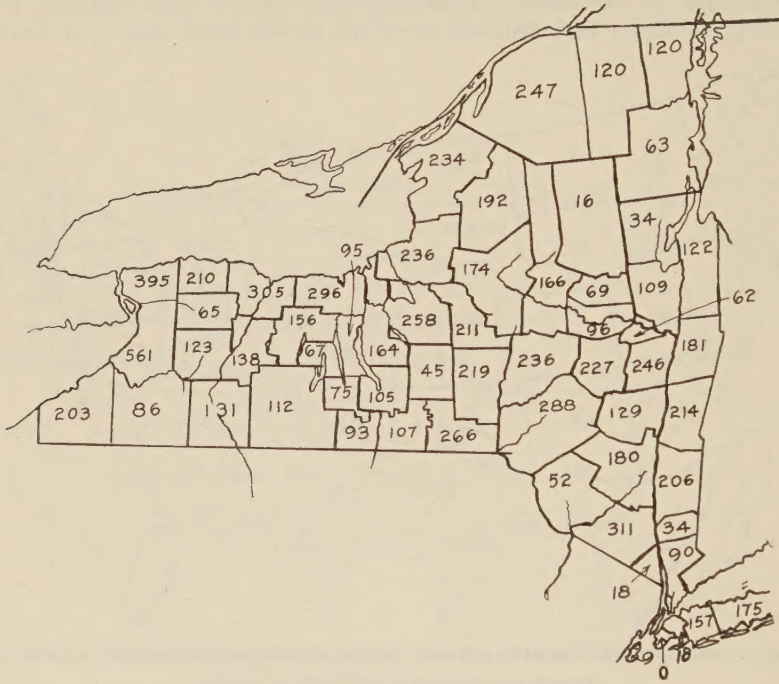

FIGURE 3. DISTRIBUTION OF 9317 FARM MOTOR-TRUCK OWNERS AS REPORTED BY FARM BUREAU COMMITTEEMEN AND CROP REPORTERS, JUNE 1, 1921

on June 1, 1921. In figure 3 the distribution of the farms having trucks is shown by counties, and the percentage of farms having trucks in each county is shown in figure 4.

Counties producing a large amount of perishable products have the greatest percentage of farm-truck owners. The Lake Ontario fruit belt and the fruit section of the lower Hudson River Valley, the garden-truck areas around large cities, and sections producing large amounts of market milk, are the places where one finds the greatest percentage of farmers using trucks. In the six counties [7] of the State which have more than one hundred bearing apple trees per farm, 7.2 per cent of the farmers had trucks as compared to 4.5 per cent for all other counties.

[7] Niagara, Orleans, Monroe, Wayne, Greene, and Columbia. Data from Fourteenth Census of the United States, vol. 6, Agriculture, part 1 (1919), p. 222-227. 1922.

Questionnaire blanks on which information considered essential to a study of this kind could be reported, were mailed to all farm-truck owners whose addresses had been obtained.

Experience has shown that in sending out a questionnaire of this nature, the more questions asked, the smaller will be the number of blanks filled out and returned. However, because of the large number of addresses of motor-truck owners available, the writer decided to use a very complete and detailed blank. No questions concerning the costs of truck operation

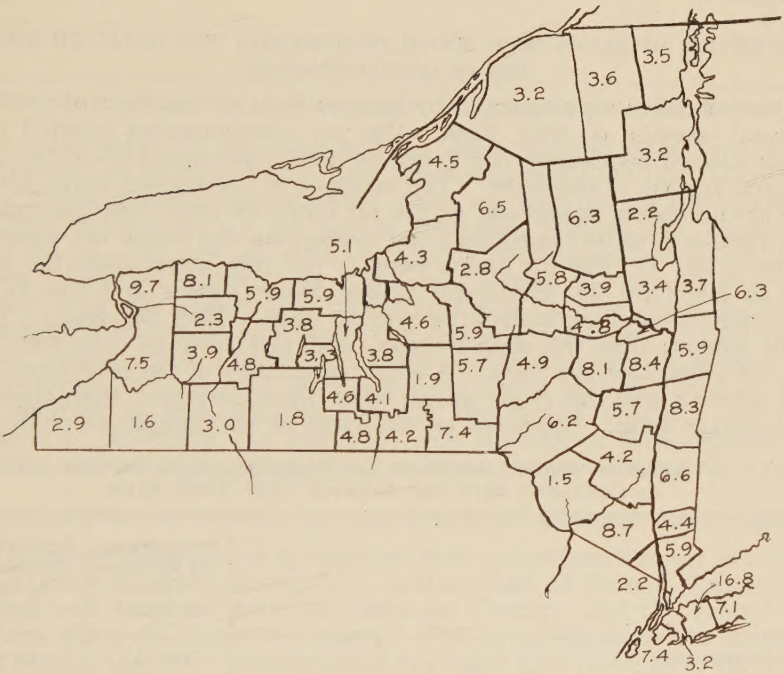

FIGURE 4. PER CENT OF FARMERS OWNING MOTOR TRUCKS IN THE VARIOUS COUNTIES OF NEW YORK, JUNE 1, 1921

(Average for the entire State, 4.8 per cent)

were, however, included in the questionnaire, as it was thought best to get this information by personal investigation.

The questionnaire, a specimen of which is shown on pages 53 and 54, asked for information on more than one hundred points pertaining to farm trucks and their relation and effect on the farm organization. The blanks, filled in, were returned by 562 farmers very evenly distributed over the State. Of these returned questionnaires, 251 were very completely filled out and were from men who had owned their trucks for at least one year. The remaining 311 were either only partly filled out, or were for trucks which had been owned for less than a year. However, some parts of these latter records could be used and certain data from them are included in this work.

In order to get information on the cost of operating trucks, personal visits were made to 103 farmers who owned trucks in the dairy sections of Chenango, Broome, and Delaware Counties, and records of costs were obtained together with data similar to that asked for on the questionnaire. The survey blank used in this work is shown on pages 55 and 56. Of these 103 men, 70 had owned their trucks for one year or more and gave complete records for a year's work. None of the cost data given by the remaining 33 men, who had not owned their trucks for a full year, are included in this study.

DESCRIPTION OF FARMS FROM WHICH INFORMATION WAS OBTAINED BY THE USE OF QUESTIONNAIRES

Questionnaires were returned by farmers from all but four of the agricultural counties of New York. The 251 questionnaires referred to as being selected because of their complete data, represented all of the agricultural regions of the State. The acreages of the various crops grown, and the number of stock kept, on the 247 farms for which this information was furnished, as compared with the average for the State, are shown in tables 1 and 2. The 247 farms were 43 per cent larger than the average as given by the fourteenth United States census, and had 81 per cent more acres of crops than the average farm. They also had 1.2 more work animals than the state average, and 13.7 cows as compared with 7.8, the average for the State. A larger percentage of the total farm area was in crops, and the crops grown were more intensive than those on the average farm. Measured on the basis of the amount of productive

TABLE 1. ACRES OF CROPS GROWN ON 247 FARMS INCLUDED IN THIS STUDY, AS COMPARED WITH THE AVERAGE NEW YORK FARM

	Acres grown on average farm of State*	Acres grown on average of 247 farms
Total farm area	106.8	152.3
Area in crops:		
Alfalfa	0.6	2.5
Barley	0.6	0.8
Beans	0.2	0.8
Buckwheat	1.1	1.4
Corn for grain	1.7	3.6
Corn for silage	1.7	5.4
Hay	24.7	32.0
Oats	4.9	9.0
Potatoes	1.6	4.5
Rye	0.6	1.2
Wheat	2.4	5.9
Orchard	3.3	11.7
Other crops	3.2	5.7
Total crop acreage	46.6	84.5
Per cent of farm area in crops	43.6	55.5

* Data from Fourteenth Census of the United States, vol. 6, Agriculture, part 1 (1919), p. 222. 1922.

TABLE 2. NUMBER OF STOCK KEPT ON 247 FARMS INCLUDED IN THIS STUDY, AS COMPARED WITH THE AVERAGE NEW YORK FARM

Kind of stock	Number on average farm of State*	Average per farm of 247 farms
Work horses and mules	2.6	3.8
Cows	7.8	13.7
Young cattle and bulls	3.3	6.3
Hogs	3.1	5.2
Sheep	3.0	8.4
Poultry	55.7	145.0

* Data from Fourteenth Census of the United States, vol. 6, Agriculture, part 1 (1919), p. 216. 1922

work represented by the crops and the stock handled, these farmers had businesses 109 per cent larger than the average, and for this reason they were probably producing more than twice as much as the average farm.[8]

These farmers did 5.3 per cent of their road hauling with horses, but they did 14.2 per cent as much trucking for their neighbors as for themselves. Detailed studies made in the dairy section of southern New York showed that the farmers who owned trucks in that area had still larger businesses than the average farm-truck owner of the State. These figures would indicate that, while only 4.8 per cent of the farmers of the State have trucks, because they have larger businesses than the average they are handling at least one-tenth of the agricultural products and farm supplies of the State. In addition, large amounts of farm produce and supplies are moved by commercial truckmen and produce buyers.

DESCRIPTION OF SECTION IN WHICH SURVEY RECORDS WERE TAKEN

The survey records used in this work were taken from farmers in an area which includes approximately the northern half of Broome County, the central and southern parts of Chenango County, and the central and western parts of Delaware County. This area lies along the northern part of the Allegheny plateau and is traversed from north to south by the valleys of the Tioughnioga, Chenango, Susquehanna, and Delaware Rivers. A railroad line runs along each of these valleys. With the exception of the lower half of that part of the Delaware River Valley which is included in this area, an improved highway of either macadam or concrete type parallels each railroad. There are few other improved highways in the area. The average elevation in this section ranges from about 950 feet in the valleys to about 1750 feet on the higher points of the intervening hills. Most of the upland soils belong to the Volusia, Lordstown, Wooster, or Lackawanna series, and the valley soils to either the Fox and Chenango or similar series.

This area receives an average rainfall of about 18 inches for the five months April to August inclusive, and has an average growing season of from 125 to 150 days.

[8] This comparison is based on productive man work units. A productive work unit is the average amount of work required to raise an acre of hay cut once. The average number per farm was 259.0 for the State and 540.1 for these 247 farms.

Owing to the general rough topography of the uplands and the limited amount of fertile valley land available, the type of farming is primarily dairying. A few potatoes and some wheat and buckwheat are raised as cash crops, but the chief product of the section is market milk, a bulky and perishable product which must be delivered daily at a railroad shipping point.

A comparison of the amount of crops and stock on these farms with the average farm of Broome, Chenango, and Delaware Counties is shown in tables 3 and 4. The average of these 70 farms was 59 per cent larger than

TABLE 3. ACRES OF CROPS GROWN ON 70 FARMS HAVING MOTOR TRUCKS IN BROOME, CHENANGO, AND DELAWARE COUNTIES, AS COMPARED WITH THE AVERAGE FARM OF THESE COUNTIES

	Acres grown on average farm*	Acres grown on average of 70 farms having trucks
Total farm area	136.4	216.4
Area in crops:		
Alfalfa	0.03	.....
Barley	0.07	0.09
Beans	0.02	.....
Buckwheat	1.14	1.58
Corn for grain	0.41	0.54
Corn for silage	1.48	7.03
Hay	33.04	55.67
Oats	3.42	9.06
Potatoes	1.07	1.64
Rye	0.06	.....
Wheat	0.18	1.40
Orchard	1.01	0.72
Other crops	1.31	0.61
Total crop acreage	43.24	78.34
Per cent of farm area in crops	31.7	36.2

*Data from Fourteenth Census of the United States, vol. 6, Agriculture, part 1 (1919), p. 222–223. 1922

TABLE 4. NUMBER OF STOCK KEPT ON 70 FARMS HAVING MOTOR TRUCKS IN BROOME, CHENANGO, AND DELAWARE COUNTIES, AS COMPARED WITH THE AVERAGE FARM OF THESE COUNTIES

Kind of stock	Number on average farm*	Average per farm of 70 farms
Work horses and mules	2.4	3.5
Cows	13.6	27.6
Young cattle and bulls	5.4	9.9
Hogs	1.9	1.7
Sheep	1.0	1.2
Poultry	53.0	82.0

*Data from Fourteenth Census of the United States, vol. 6, Agriculture, part 1 (1919), p.216–217. 1922.

the average of all farms in these three counties, and had 27.6 cows as compared with 13.6 for the average farm. About the same proportion of these farms was in crops, but they were more heavily stocked with cattle and they were raising more silage and fodder corn than the average. Measured by the work necessary to handle the crops and stock on these farms, they were 10 per cent larger than the 247 farms in various parts of the State from which similar data were obtained by the use of questionnaires, and were 128 per cent larger than the average farm of Broome, Chenango, and Delaware Counties.

SIZES OF TRUCKS USED AND PREFERRED BY FARMERS

Of the 562 men who returned questionnaires, 556 had only one truck, 3 had two, and 3 had three. The number of trucks of the different sizes used by the 561 farmers who reported this information is shown in table 5. Of these trucks, 44 per cent were of the 1-ton size and 26 per cent were ½-ton

TABLE 5. SIZES OF TRUCKS USED BY NEW YORK FARMERS

Size of trucks	Questionnaire records from all parts of State		Survey records from Broome, Chenango, and Delaware Counties	
	Number of this size	Per cent of total	Number of this size	Per cent of total
½ ton	148	26.0	36	35.0
¾ ton	41	7.2	7	6.8
1 ton	250	43.8	41	39.8
1¼ tons	16	2.8	2	1.9
1½ tons	52	9.1	12	11.7
2 tons	42	7.4	3	2.9
Over 2 tons	21	3.7	2	1.9
Total	570*	100.0	103	100.0

* Three of the men reporting had 2 trucks each and three had 3 each. One did not report the size used.

trucks. Only 21, or less than 4 per cent, of these men were using trucks larger than the 2-ton size. The 103 truck owners from whom survey records were taken had about the same percentage of 1-ton trucks as these 561 farmers, but 35 per cent of their trucks were of the ½-ton size as compared with 26 per cent for the 570 trucks of the men located in various parts of the State.

Two of the questions asked on the questionnaire were, "If you did not own a truck, would you buy one?" and "What size would you get?" The way in which the first question was answered by the men who had owned their trucks for a year or more is shown in table 6. Of the 385 men who gave this information, 361 said that they would buy a truck and 15 that they would not, and 9 stated that they were undecided.

Answers to the second question were given by 345 men, and the sizes of trucks which they preferred are tabulated in table 7. The number of

TABLE 6. REPORTS ON THE QUESTION, "IF YOU DID NOT OWN A TRUCK, WOULD YOU BUY ONE?"

(411 truck owners)

Size of truck owned	Yes	No	Uncertain	No report	Total
½ ton	93	3	4	8	108
¾ ton	24	2	1	1	28
1 ton	160	9	2	9	180
1¼ tons	8	1	1	.....	10
1½ tons	38	.....	.....	3	41
2 tons	21	.....	1	4	26
Over 2 tons	17	.....	.....	1	18
Total	361	15	9	26	411

TABLE 7. SIZES OF TRUCKS PREFERRED BY 345 MEN WHO HAD OWNED THEIR TRUCKS FOR ONE YEAR OR MORE

Size of truck now owned	½ ton	¾ ton	1 ton	1¼ tons	1½ tons	2 tons	Over 2 tons	Total
Number of this size	94	22	153	7	32	20	17	345
Number of men preferring each size:								
½ ton	28	....	2	....	....	....	....	30
¾ ton	8	6	1	....	....	....	....	15
1 ton	47	9	107	....	6	1	....	170
1¼ tons	....	3	4	3	....	....	1	11
1½ tons	5	3	26	1	12	2	1	50
2 tons	6	1	8	3	10	13	1	42
2½ tons	....	....	2	....	4	1	5	12
3 tons	....	....	2	....	....	2	5	9
3½ tons	....	....	1	....	....	1	1	3
4 tons	....	....	....	....	....	....	1	1
5 tons	....	....	....	....	....	....	2	2

men who preferred the same size as they then owned, and the number preferring larger and smaller sizes, are shown in table 8. There seemed to be a general tendency for the men to think that their trucks were not large enough. Of the farmers reporting, 52 per cent were satisfied with the size they were using, and 43 per cent preferred larger sizes as compared with 5 per cent who preferred smaller trucks.

Of the 251 truck owners who sent complete reports, 32 had owned trucks before buying the ones they then had. The average size of the trucks previously owned was 0.74 ton as compared with 1.26 tons for the size of the trucks owned at the time of reporting. Of these 32 men, 13 reported that they had disposed of their old trucks because they were not large enough. The 1-ton truck had the largest percentage of owners who were satisfied as far as size of truck was concerned, and was preferred by the largest number

TABLE 8. NUMBER OF MEN PREFERRING LARGER OR SMALLER TRUCKS THAN SIZE OWNED

Size of truck owned	Number of each size reported	Size preferred		
		Same size	Larger size	Smaller size
½ ton	94	28	66	.....
¾ ton	22	6	16	.....
1 ton	153	107	43	3
1¼ tons	7	3	4	.....
1½ tons	32	12	14	6
2 tons	20	13	4	3
Over 2 tons	17	11	2	4
Total	345	180	149	16

of owners who were not satisfied with the size they then had. Of the 116 men having trucks of less than 1-ton capacity, 82 said they would get a larger size, and 56 specified 1 ton trucks. Of the 119 men who were not using 1-ton trucks and were not satisfied with the size they had, 63 said they would prefer a 1-ton truck, and, in all, 170 out of the 345 truck owners would have bought 1-ton trucks if they were to replace the ones they then owned.

Relation of type of roads to size of trucks used

The men who were doing their driving on all dirt roads, and those who had partly improved roads, were using trucks of about 1 ton capacity (table 9). Truck owners who had all improved roads were using trucks of about 1¼ tons capacity. The average size of trucks preferred by the men having all dirt roads was 1.23 tons, and the average size preferred by the men having all improved roads was 1.53 tons. None of these three groups were loading their trucks to full capacity, but the men on the improved roads came the nearest to doing so.

TABLE 9. RELATION OF TYPE OF ROAD TO SIZE OF TRUCK OWNED, AND SIZE PREFERRED, BY 251 TRUCK OWNERS

Type of road*	Number of trucks	Average size of truck owned	Size of truck preferred	Average weight of loads hauled
Unimproved	64	1.04 tons	1.23 tons	0.95 ton
Partly improved	133	1.02 tons	1.27 tons	1.00 ton
Improved	54	1.23 tons	1.53 tons	1.17 tons
Total and average	251	1.07 tons	1.32 tons	1.02 tons

* Macadam, brick, concrete, or asphalt roads considered as improved roads.

MAKES OF TRUCKS USED

There were 60 makes of trucks reported by men who returned questionnaires and those from whom survey records were obtained. The different makes of trucks owned, and the number of each make, reported by the 562 farmers who returned questionnaires are shown in table 10:

TABLE 10. MAKES OF TRUCKS USED ON 562 NEW YORK FARMS

Make	Number of each make	Per cent of total number of all trucks
Ford	353	61.8
Reo	22	3.9
Republic	18	3.2
International	15	2.6
Maxwell	13	2.3
Buick	9	1.6
Samson	9	1.6
Federal	9	1.6
G. M. C.	8	1.4
Dodge	8	1.4
Stewart	6	1.1
White	6	1.1
Ford-Smith	6	1.1
Commerce	6	1.1
Chevrolet	5	0.9
Brockway	5	0.9
Ford-Graham	5	0.9
Overland	5	0.9
Olds	4	0.7
Mack	3	0.5
Selden	3	0.5
Studebaker	3	0.5
Traffic	3	0.5
Vim	3	0.5
Chase	2	0.3
Ford-Dearborn	2	0.3
Ford-Kelly	2	0.3
Nash	2	0.3
Packard	2	0.3
Sanford	2	0.3
Service	2	0.3
Alco	1	0.2
Autocar	1	0.2
Bessemer	1	0.2
Case	1	0.2
Chalmers-Hutford	1	0.2
Day Elder	1	0.2
Dunor	1	0.2
Ford-Babcock	1	0.2
Ford-Traffic	1	0.2
Ford-Truxton	1	0.2
Fulton	1	0.2
Garford	1	0.2
Hewitt	1	0.2
Hudson-Dearborn	1	0.2
Hutford	1	0.2
Indiana	1	0.2

TABLE 10 (*concluded*)

Make	Number of each make	Per cent of total number of all trucks
Jeffrey	1	0.2
Kohler	1	0.2
Monominee	1	0.2
Olsen	1	0.2
Paige	1	0.2
Palmer-Moore	1	0.2
Peerless	1	0.2
Pierce Arrow	1	0.2
Stegman	1	0.2
Sullivan	1	0.2
Velie	1	0.2
Ward La France	1	0.2
Not reported	2	0.3
Total	571	

TIRE EQUIPMENT USED

Information as to the types of tires used on trucks was given on questionnaires by 540 truck owners. The number of trucks of the different sizes which were equipped with solid and pneumatic tires, and the number equipped with pneumatic front and solid rear tires, are shown in table 11. A large proportion of the owners of small trucks were using pneu-

TABLE 11. NUMBER OF TRUCK OWNERS USING SOLID AND PNEUMATIC TIRES

Size of trucks	Number of owners using this size	Number using all pneumatic tires	Number using all solid tires	Number using pneumatic front and solid rear tires
½ ton	142	133	4	5
¾ ton	40	32	6	2
1 ton	238	125	14	99
1¼ tons	13	10	1	2
1½ tons	48	17	19	12
2 tons	39	7	24	8
Over 2 tons	20	2	17	1
Total	540	326	85	129

matic tires, while the solid tires seemed to meet the approval of the men with large trucks better than did the pneumatic tires. Of the trucks of less than 1½ tons capacity 70 per cent had all pneumatic tires, while of the trucks above this size only 15 per cent were so equipped. In all, 60 per cent of the trucks for which this information was obtained had all

pneumatic tires and 16 per cent had all solid tires. The remainder had pneumatic front and solid rear tires.

Some of the advantages of the pneumatic over the solid tires, as given by truck owners, were: less jar and consequently less injury to the load and truck; capability of greater speed; ability to run on softer ground than solid tires can; a special type of wheels not required; lower initial cost; and special labor and equipment for changing not required. Disadvantages of pneumatic tires, as reported by men using them, were: danger of blow-outs and punctures; time and inconvenience of keeping the tires inflated; inability to stand use on rough frozen roads; and wearing quality not so good as that of solid tires.

The number of trucks reported as being equipped with single and dual rear tires is shown in table 12. Of the 528 men who reported whether

TABLE 12. NUMBER OF TRUCK OWNERS USING SINGLE AND DUAL REAR TIRES

Size of trucks	Number of owners reporting	Number using single rear tires	Number using dual rear tires
½ ton	139	139	.....
¾ ton	38	38	.....
1 ton	236	235	1
1¼ tons	13	13	.....
1½ tons	45	45	.....
2 tons	38	30	8
Over 2 tons	19	11	8
Total	528	511	17

they were using single or dual rear tires, only 17 were using the dual type. Eight of these were using 2-ton trucks, and eight were using trucks larger than the 2-ton size. One owner of a 1-ton truck reported that he was using dual tires. The advantages of dual rear tires, as given by men using them, were that they would give more traction than single tires and that they were less likely to skid or slide on slippery roads.

It would seem, therefore, that the most satisfactory type of tires for any particular truck would depend on the material to be hauled, the speed desired, the type and probable condition of roads over which hauling would be done, the care which the driver would be likely to give to pneumatic tires, and the relative cost of the two types.

DISTANCE OF TRUCK OWNERS FROM MARKET

Each truck owner was asked how far his farm was from his principal market. The average distance from market of the farmers who furnished this information on their questionnaires is shown in table 13. Approximately one-third of the truck owners were less than five miles from market, one-third from five to ten miles, and the remainder eleven miles or more. The distance of the individual farmers from market varied fro n one-tenth of a mile to seventy miles, and the average of all reporting was 9.4 miles.

TABLE 13. DISTANCE FROM PRINCIPAL MARKET OF 509 NEW YORK FARM MOTOR-TRUCK OWNERS

Miles from market	Number of owners reporting	Per cent of total number of all trucks	Average miles to market
Under 5	178	35.0	2.8
5 to 10	183	36.0	6.8
11 to 15	51	10.0	13.0
16 to 20	40	7.8	18.4
Over 20	57	11.2	28.7
Total	509	100.0	9.4

About the same proportion of the farmers having small trucks as of those having large trucks were marketing at points nearer and points more distant than ten miles from their farms (table 14). Some of the farmers had changed their principal markets since they began to use trucks. Of the

TABLE 14. NUMBER OF TRUCKS OF EACH SIZE AT DIFFERENT DISTANCES FROM MARKET

Miles from principal market	Size of trucks						
	½ ton	¾ ton	1 ton	1¼ tons	1½ tons	2 tons	Over 2 tons
Under 5	57	12	71	6	15	14	3
5 to 10	42	12	91	4	20	10	4
11 to 15	15	4	23	3	2	3	1
16 to 20	8	6	15	1	5	4	1
Over 20	10	4	26	.....	5	3	9
Total	132	38	226	14	47	34	18

411 men who had owned trucks for one year or more, 355 reported as to whether or not they had changed their markets. Of this number, 289 stated that they had not changed their principal markets and 66 stated that they had. These 66 farmers had been marketing their principal products at markets averaging 5.9 miles distant before they began to use trucks, but at the time of reporting they were marketing at points averaging 14.5 miles distant.

The average distance from market of the 103 farms in the dairy section of southern New York from which survey records were obtained was 5.5 miles (table 15), as compared with 9.4 miles for the average of the 509 farmers who reported this information by the questionnaires. The fact that these 103 farmers are marketing their products at points nearer than the average of the 509 men in various parts of the State, is probably accounted for in large part by the fact that their chief sales product is market

TABLE 15. DISTANCE FROM PRINCIPAL MARKET OF 103 FARM MOTOR-TRUCK OWNERS IN BROOME, CHENANGO, AND DELAWARE COUNTIES

Miles from market	Number of owners reporting	Per cent of total number of all trucks	Average miles to market
Under 5	53	51.4	2.9
5 to 10	39	37.9	6.4
11 to 15	7	6.8	13.0
16 to 20	4	3.9	17.0
Over 20	0	0.0	.....
Total and average	103	100.0	5.5

milk, a bulky and highly perishable product which must be delivered daily at a railroad shipping point. Whole milk cannot be economically marketed at as great a distance from the point of production as can less bulky or perishable farm products such as grain, fruit, and potatoes, which make up a large proportion of the total production of the average farm in New York.

The introduction of trucks into this region seems to have extended the market milk territory farther back into the hill country. A considerable amount of milk which was formerly hauled by horse and wagon to near-by creameries and cheese factories, is now hauled by truck to a railroad and marketed as whole milk. Results of a survey of the cost of producing milk on 149 farms in this region in 1915 agrees with this observation.[9] The average distance to market of these 149 farms was 4 miles, as compared with 5.5 miles for the 103 dairy farms from which truck survey records were obtained.

SPEED OF TRUCKS

The average speed in miles per hour at which 250 of the trucks for which questionnaires were available were driven, is shown in table 16.

TABLE 16. SPEED OF TRUCKS

Size of trucks	Number of owners reporting	Average speed of trucks in miles per hour	
		Loaded	Empty
½ ton	64	16.3	21.3
¾ ton	14	18.2	21.4
1 ton	116	12.6	15.4
1¼ tons	5	15.4	20.5
1½ tons	24	14.9	17.9
2 tons	18	13.6	15.4
Over 2 tons	9	13.1	14.8
Total and average	250	14.2	17.6

[9] An economic study of dairying on 149 farms in Broome County, New York. By E. G. Misner. Cornell Univ. Agr. Exp. Sta., Bul. 409, p. 400. 1922.

Only 17 per cent of the 116 men having 1-ton trucks were doing the principal part of their driving on improved roads of macadam, brick, or concrete, while 30 per cent of the trucks larger than 1 ton were being driven on roads of these types. This fact probably accounts, at least in part, for the comparatively low speed at which the 1-ton trucks were driven. The relation of type of road to speed of trucks is shown in table 17:

TABLE 17. RELATION OF TYPE OF ROAD TO SPEED OF TRUCKS

Type of road*	Number of owners reporting	Average speed of trucks in miles per hour	
		Loaded	Empty
Unimproved	143	12.8	16.9
Partly improved	286	14.7	18.1
Improved	123	15.3	18.4
Total and average	552	14.3	17.9

* Macadam, brick, concrete, or asphalt roads considered as improved roads.

COSTS OF OPERATING TRUCKS

The average individual costs which make up the total average annual cost of operating the 70 trucks for which complete cost data for one year were obtained, are shown in table 18. The average annual cost of operat-

TABLE 18. AVERAGE ANNUAL COST OF TRUCK OPERATION, EXCLUSIVE OF COST OF DRIVER

(70 trucks in Broome, Chenango, and Delaware Counties)

Number of trucks	70
Average size, in tons	0.91
Average value	$654.10

	Cost per truck	Per cent of total cost
Costs:		
Depreciation	$105.77	26.8
Interest	39.25	9.9
Insurance	0.81	.....
License	12.29	3.1
Cash repairs	92.01	23.3
Farm labor, repairing, 31.3 hours	8.15	2.1
Gasoline, 381.7 gallons	105.29	26.7
Motor oil, 24.92 gallons	22.43	5.7
Grease	2.33	.....
Use of buildings	6.71	1.7
Total costs	$395.04	

ing a truck, exclusive of cost of driver, was $395.04. Depreciation and fuel were the two largest items of expense, each making up 27 per cent of the total annual cost. Repairs, including value of farm labor used for repair

work, was the next largest item. This amounted to $100.16 per truck. Other costs in order of size were interest, lubrication, license, use of buildings, and insurance.

It can be said that depreciation, fuel, and repairs, each made up approximately one-fourth of the total cost; and interest, lubrication, license, use of buildings, and insurance, together made up the remaining fourth.

Investigations conducted by the Department of Agricultural Economics and Farm Management of the New York State College of Agriculture have shown that the annual cost of maintaining general farm equipment exclusive of trucks, tractors, threshing machines, and some other special equipment, represents about 30 per cent of the average investment.[10] The average value of the trucks included in table 18 was $654.10, and the total annual cost of $395.04 represented 60.4 per cent of this amount. Measured by the percentage of the average investment which the annual cost represents, the cost of operating these trucks, including the cost of gasoline, was double the cost of the general farm equipment as found by cost-account methods. The cost per truck exclusive of gasoline was $289.75, which is 44.3 per cent of the average investment.

Initial cost of trucks

Of the 562 farmers who returned questionnaires, 336 reported that they had purchased their trucks new, 123 that they had purchased second-hand trucks, and 50 that they had built their trucks from automobiles. The remaining 53 did not report on this point. The average initial cost to these men of their trucks is shown in table 19. The cost of the trucks built from automobiles includes the value of the labor spent in building them over.

TABLE 19. AVERAGE INITIAL COST OF TRUCKS PURCHASED NEW, PURCHASED SECOND-HAND, OR BUILT FROM AUTOMOBILES, 509 TRUCKS

Size of trucks	New		Second-hand		Built from automobiles		Total and average	
	Number	Cost	Number	Cost	Number	Cost	Number	Cost
½ ton	50	$ 645.84	51	$ 331.47	27	$340.22	128	$ 456.12
¾ ton	24	1,234.31	8	551.88	5	296.40	37	960.02
1 ton	180	888.77	40	573.88	12	551.67	232	817.04
1½ tons	10	1,494.10	3	741.67	1	300.00	14	1,261.86
1½ tons	34	1,657.26	9	579.44	2	525.00	45	1,391.38
2 tons	23	2,536.35	8	1,131.25	3	650.00	34	2,039.29
Over 2 tons	15	3,306.67	4	1,525.00	.....	.....	19	2,931.58
Total and average	336	$1,193.80	123	$543.62	50	$415.76	509	$960.26

Cost of second-hand trucks

The second-hand trucks, which were purchased at an average price of $543.62, cost less than half the average price paid for the trucks bought new, and the average cost of the trucks built over from automobiles was

[10] Cost accounts for six years on some successful New York farms. By G. F. Warren, Van B. Hart, and others. Cornell Univ. Agr. Exp. Sta., Bul. 414, p. 65. 1923.

$415.76. Owners who had used second-hand trucks for an average of 25 months, and owners who had used built-over trucks for 28 months (table 20), estimated that they would get additional satisfactory service of 4.3 years and 4.4 years, respectively, from their trucks. This makes the estimated average years of usefulness to the present owners of the built-over trucks 6.5 years, and of the second-hand trucks 6.4 years.

TABLE 20. AVERAGE INITIAL COST, YEARS OF USEFULNESS TO PRESENT OWNERS, AND DAYS LAID UP FOR REPAIRS, OF TRUCKS PURCHASED NEW, PURCHASED SECOND-HAND, OR BUILT FROM AUTOMOBILES

(251 trucks owned one year or more)

How acquired	Number of trucks	Cost	Months owned by present owner	Additional years of service expected	Years of usefulness to present owner	Days per annum laid up for repairs
Bought new	150	$1,209.11	29.5	5.6	8.1	1.9
Bought second-hand	74	570.88	25.0	4.3	6.4	1.3
Built from automobiles	27	373.08	28.0	4.4	6.7	2.2
Total and average	251	$944.68	28.0	5.1	7.4	1.7

Cost of trucks included in survey work

The average initial cost of the 70 trucks located in the dairy section of the southern part of the State is shown in table 21:

TABLE 21. AVERAGE INITIAL COST OF 70 TRUCKS INCLUDED IN SURVEY WORK

Size of trucks	Number of trucks	Average initial cost
½ ton	27	$ 449.63
¾ ton	6	1,187.83
1 ton	24	837.00
1½ tons	10	1,485.00
2 tons	1	1,200.00
2½ tons	2	3,100.00
Total and average	70	$880.00

Depreciation

The largest single item of cost of operating farm trucks, as shown in table 18, was depreciation. The depreciation on these trucks made up 26.8 per cent of the total annual cost of operation, and was 16.2 per cent of the average value of the trucks. Of the 70 trucks included in table 18, 41 had been purchased new by their present owners and 29 had been either bought second-hand or built over from passenger cars.

The average age, at the time of the survey, of the 41 trucks that had been purchased new was 2.22 years. During the first 1.2 years that these trucks were in use, they depreciated from an average value of $1066 to $853. This represents a depreciation of 20 per cent of the original purchase price of the trucks in a period of 1.2 years. During the year following,

the average depreciation was $134.85, or 12.6 per cent of the first cost. The owners of these trucks estimated that their trucks would give an average of 5.2 years of additional service, making the life of the average truck 7.42 years. (Table 40.)

If it is assumed that the average truck lasts 7.42 years, its average annual depreciation would be 13.5 per cent, but the foregoing data agree with the common observation that the depreciation on any kind of farm machinery is much higher for the first few years of use than the average. When these trucks had been in use for a little more than two years, they had depreciated 32.6 per cent of their original cost. The relative depreciation measured in per cent of original cost of trucks of different ages is shown in table 22:

TABLE 22. RELATION OF AGE OF TRUCK TO PERCENTAGE OF INITIAL COST REPRESENTED BY ANNUAL DEPRECIATION

Age of truck at beginning of year	Number of trucks	Average age at beginning of year (months)	Per cent of initial cost represented by depreciation
New	7	0.0	19
1 to 12 months	17	5.1	14
13 to 24 months	9	18.2	9
Over 24 months	8	43.6	8
Total and average	41	14.6	13

The average estimated junk or scrap value of these trucks at the end of 7.42 years was estimated to be $155, or 14.5 per cent of the initial cost. Since the total estimated depreciation for the first four years of use, as shown in table 22, was only 50 per cent of their initial cost, the trucks would have to depreciate 35.5 per cent more during the last 3.42 years of life in order to be worth only $155 as junk. Depreciation on trucks approximately four years old was 8 per cent of the initial cost. Since depreciation usually decreases with age, it would not be expected that these trucks would depreciate 35.5 per cent more during their last three and one-half years of life. This study was made at the end of a period of rapidly rising prices. Truck owners were asked, in estimating depreciation, to disregard any change in price which had occurred since purchasing their trucks, but they were probably influenced by the rapid rise in prices during the preceding year and did not place a low enough value on their trucks. The estimate of length of life of the trucks was independent of the estimate of depreciation, and is likely to be more nearly correct. Estimates on length of life of trucks furnished by 150 truck owners from other parts of the State, agree with these data (table 24).

Depreciation on trucks computed on a fixed percentage basis

When the initial cost, the years of life, and the scrap value of a machine are known, it is possible to compute a rate of depreciation which charges off each year the same percentage of the value at the beginning of the

year.[11] This allows a higher depreciation when the machine is new, and a constantly decreasing amount as it grows older. Depreciation on these trucks for any particular year computed in this way would be 23 per cent of their value at the beginning of that year, or about one-fourth more for the first four years than is shown in table 22.

Not until trucks have been in use longer, can exact depreciation figures be obtained, but the average rates of depreciation as computed by the foregoing method are given in table 23, and these figures are probably very near the actual rates at which farm trucks depreciate.

TABLE 23. ANNUAL DEPRECIATION ON 41 TRUCKS, COMPUTED FROM ESTIMATED USEFULNESS OF 7.42 YEARS, INITIAL COST OF $1066, AND ESTIMATED SCRAP VALUE OF $155

Years used	Value at beginning of year	Depreciation	Value at end of year	Per cent depreciation is of value at beginning of year	Per cent this year's depreciation is of initial cost
0	$1,066.00	$245.18	$820.82	23.0	23.0
1	820.82	188.79	632.03	23.0	17.7
2	632.03	145.37	486.66	23.0	13.6
3	486.66	111.93	374.73	23.0	10.5
4	374.73	86.19	288.54	23.0	8.1
5	288.54	66.36	222.18	23.0	6.2
6	222.18	51.10	171.08	23.0	4.8
7*	171.08	16.08	155.00	.....	1.6*
Scrap value	.....	.....	155.00	.....	14.5

* This horizontal column covers only 0.42 year.

Depreciation on trucks compared with depreciation on other farm machinery

The motor truck is a comparatively new addition to the equipment of New York farmers, and experience has shown that depreciation is very high on new kinds or types of farm machines, regardless of whether or not they are given hard usage. Any new type of machine will tend to depreciate because of its becoming obsolete due to the manufacture of improved models which relegate the older machines to the junk pile long before they are worn out. Few of the old wire grain binders were worn out. They were abandoned because better machines took their place. New kinds of machines are also more liable to breakage because of faulty construction than are those which have been tested for many years. A study of tractors on New York farms [12] showed that the average life of the tractors studied

[11] The formula used, which is known as the fixed percentage of the decreasing net value, is

$$R = 1 - \sqrt[n]{\frac{V_2}{V_1}}$$

in which R is the rate per cent of depreciation per year, n is the life in years, V_1 is the initial cost, and V_2 is the scrap value. According to this formula, if the initial cost were $1000 and R were found to be 20 per cent, the value of the truck at the end of the first year would be $1000−$200, or $800. The depreciation for the next year would be 20 per cent of $800, or $160.

[12] An economic study of farm tractors in New York. By W. I. Myers. Cornell Univ Agr. Exp. Sta., Bul. 405, p. 66. 1921.

was 6 years, as compared with 7.42 years for the farm trucks included in table 23. Similar studies of other special farm equipment have shown that depreciation is very high on any new type of machine. The first grain binders and the first tractors were designed and manufactured for farm use and could not be tested in any way except by putting them in practical use on farms. Motor trucks, the manufacture of which was developed by the automobile industry, had been well tested and had passed thru the early part of the experimental stage before they reached the farm.

In making this study the writer did not find, nor has he ever seen, a serviceable motor truck that had been abandoned by a farmer because its place had been taken by a more improved type, but he did see tractors, ensilage cutters, and potato diggers which probably would do almost as good work as when first purchased but which were not used because their place had been taken by more improved machines. Many farmers have sold or turned in their old trucks for new ones; but they did this, not because their trucks were out of date, but because they were wearing out. Had the old trucks been obsolete, no one else would have wanted them and they would have joined the class of the chain-carrier ensilage cutter and the double-driving harness which are found stored away on many farms — still serviceable, but their place taken by something better.

Farmers paid for the testing and development of the grain binder and the gas tractor, but profited by the mistakes others had made in the manufacture of automobiles and motor trucks. Because of this fact one would not expect to find a high depreciation on farm motor trucks due to their becoming obsolete, as has been observed in the past on tractors and other new kinds of complicated farm machinery. The actual depreciation on the trucks included in this study agrees with this observation.

Relation of hauling done with trucks, to length of life of trucks

The extent to which a machine is used generally affects the rate at which it depreciates. The trucks that did less than 600 miles of hauling were estimated by their owners to last 9.5 years, and owners of trucks doing from 600 to 1200 miles of hauling estimated the life of their trucks at 7 years. The trucks doing over 1200 miles of hauling were estimaetd to last 8 years, but they were laid up for repairs almost twice as long as were the 47 trucks that were used for less than 600 miles (table 24).

TABLE 24. RELATION OF MILES OF HAULING TO LENGTH OF LIFE AND TO OTHER FACTORS

(150 trucks bought new and owned for one year or more)

Miles of hauling	Number of trucks	Average miles of hauling	Estimated average length of life (years)	Average days per annum laid up for repairs
Under 600	47	329.0	9.5	1.4
600 to 1200	49	874.8	7.0	1.7
Over 1200	54	2,280.9	8.0	2.6
Total and average	150	1,210.0	8.1	1.9

Repairs

New parts and cash repairs on these trucks cost $92.01 per truck (table 25), and the farm labor spent in repairing them was valued at $8.15 per truck.

TABLE 25. COST OF CASH REPAIRS AND NEW PARTS, 70 TRUCKS

Part repaired or replaced	Number of owners having this expense	Average cost per truck	Per cent of total cash repair cost
Tires	54	$54.47	59.2
Batteries	8	1.25	1.4
Spark plugs	28	1.06	1.2
Radiators	14	2.21	2.4
Gears	11	5.96	6.5
Brakes	28	3.30	3.6
Body	4	0.68	0.7
Unclassified	34	23.08	25.0
Total	.....	$92.01	100.0

The cost of tire repairs was the largest single item of repair expense reported, and made up 59.2 per cent of the total cash repair charges. Repairs on gears and on brakes were the two next largest items, making up 6.5 per cent and 3.6 per cent, respectively, of the total cash amount paid for repairs.

Since in most cases home repair work was done by the person driving the truck, such labor was charged for at the same rate as the driver's time. Farm labor on repairs averaged 31.3 hours per truck. The cash cost of repairs and the amount of farm labor spent in repairing varied greatly. Five farmers had no cash expenses for repairs, and the largest amount spent by any truck owner for this item was $400.

The largest amount of farm labor spent on any one truck was 156 hours, and 33 owners did no repair work with farm labor. The five truck owners who had no cash expenses for repairs also had no repairing done by farm labor. Three of the five trucks which had no repairs during the year had been purchased new at the beginning of the year, and one had been purchased new three months prior to that time. The fifth had been bought new by the present owner and had been in use for three years and one month before the beginning of the year. The average depreciation on these five trucks was 18 per cent of their initial cost, as compared with 12.7 per cent for all trucks that were purchased new by their present owners. These five trucks were driven an average of only 2770 miles during the year, as compared with 3589 miles which was the average for the 41 trucks included in table 23. This fact probably accounts, either in part or entirely, for the lack of repairs on these trucks.

Relation of age of truck to days laid up for repairs

There was no very direct relation between the age of the average truck, and its reliability as measured by days laid up for repairs (table 26). The

amount of hauling done with a truck (table 24), and the type of roads over which it is driven (table 59), seem to have more effect on the time it is laid up for repairs than does the factor of age (table 26). While the trucks used the most were estimated to last as long as the others, they were laid up for repairs about a third longer time than was the average truck.

TABLE 26. RELATION OF AGE OF TRUCK TO DAYS LAID UP FOR REPAIRS

(150 trucks purchased new and owned for twelve months or more)

Months owned	Number of trucks	Average number of months owned	Average number of miles of road hauling	Average number of days per annum laid up for repairs	Additional years of service expected	Average number of years of service
12	27	12	1,220.0	1.8	6.75	7.8
13 to 24	53	19.3	1,102.7	1.7	5.3	6.9
25 to 36	32	32.9	1,310.1	0.5	5.1	7.8
37 to 48	21	44.6	1,009.1	5.0	5.0	8.8
49 and over	17	63.8	1,576.5	1.4	5.4	10.7
Total and average	150	29.5	1,208.6	1.9	5.5	8.0

Relation of age of truck to depreciation and repairs

The percentage of the initial cost of the trucks which was represented by the sum of depreciation and repairs, was a smaller figure for the older trucks than for the newer ones (table 27). Depreciation and repairs were 25.8 per cent of the initial cost of the new trucks, and only 17.8 per cent of

TABLE 27. RELATION OF AGE OF TRUCK TO DEPRECIATION AND OTHER FACTORS

	Age, in months, at beginning of year				
	New	0 to 12	13 to 24	Over 24	Total and average
Number of trucks	7	17	9	8	41
Average age, in months	0	5.1	18.2	43.6	14.6
Average size, in tons	0.93	1.06	0.78	0.91	0.95
Per cent of initial cost represented by sum of depreciation and repairs	25.8	23.3	19.1	17.8	21.7
Days per annum laid up for repairs	0	1.2	0.3	4.5	1.4

the first cost of the oldest trucks. However, none of the seven new trucks were laid up for repairs for an entire day when needed, and the trucks owned for more than two years lost 4.5 days per truck due to this cause.

Depreciation on trucks decreases with age and repairs increase, but depreciation is so high for the first years that the sum of depreciation and repairs, when expressed in per cent of initial cost, is a constantly decreasing

figure. If truck owners could insure themselves against loss of time and inconvenience caused by their trucks breaking down, and could get this insurance at just what it costs to carry the risks involved, one might find that depreciation plus repairs plus the cost of this risk insurance was a constant quantity. In other words, the sum of depreciation and repairs decreases with age, but the decrease is probably about offset by the chances that a truck will break down at the time when it is needed the most.

Gasoline

The second largest expense on these trucks was for gasoline, which was practically as important an item as depreciation. The average amount of gasoline used per truck was 381.7 gallons and the average price paid per gallon was 27.6 cents. Gasoline was the only kind of fuel used, and the writer found no farmers who had attempted to use kerosene or distillate in their trucks. These low-grade fuels, which are used extensively in low-speed stationary engines and in tractors, have not proved successful when used for truck motors. The chief objection to them is their tendency to foul up the spark plugs and cylinder heads of the motors with carbon, and the excessive amount of smoke and oil which they give off on combustion.

The average number of miles per gallon of gasoline, and the cost per mile for gasoline, are shown in table 28. For the number of tons which they could carry, the larger trucks were more economical in use of fuel than the smaller ones. The 33 trucks of less than 1 ton capacity averaged 12.4 miles per gallon of gasoline, but, since their average size was only 0.55 ton, they made only 6.8 miles per gallon per ton of carrying capacity; while the 1-ton trucks, and the trucks larger than 1 ton, made 9.5 miles and 13.1 miles per gallon per ton, respectively.

TABLE 28. AVERAGE CONSUMPTION OF GASOLINE BY 70 TRUCKS

Size of trucks	Number of trucks	Average size (tons)	Total miles traveled	Gasoline			
				Gallons	Value	Miles per gallon	Cost per mile
Under 1 ton.....	33	0.55	3,811	306.7	$ 84.08	12.4	$0.022
1 ton.....	24	1.00	3,574	375.0	101.64	9.5	0.028
Over 1 ton.....	13	1.70	4,531	584.4	165.88	7.8	0.037
Total and average.....	70	0.91	3,863	381.7	$105.29	10.1	$0.027

Relation of age of truck to economy in use of gasoline

The mileage per gallon per ton of capacity was the largest for the new trucks and decreased with age (table 29). The trucks over two years old made only 7.3 miles per gallon per ton, as compared with 9.6 miles for the new trucks.

TABLE 29. RELATION OF AGE OF TRUCK TO ECONOMY IN USE OF GASOLINE AND OIL, 41 TRUCKS

	Age, in months, at beginning of year				
	New	0 to 12	13 to 24	Over 24	Total and average
Number of trucks	7	17	9	8	41
Average age, in months	0	5.1	18.2	43.6	14.6
Average size, in tons	0.93	1.06	0.78	0.91	0.95
Miles per gallon of gasoline	10.3	8.9	10.7	8.0	9.2
Miles per gallon per ton of capacity	9.6	9.4	8.3	7.3	8.7
Miles per quart of oil	29.3	47.5	66.1	24.8	39.5
Miles per quart per ton of capacity	27.2	50.4	51.6	22.6	37.5

Lubrication

These trucks used 24.92 gallons of motor oil per truck, and other lubrication costs amounted to $2.33 per truck. The average price paid for motor oil was 90 cents per gallon. The number of pounds of grease used per truck was not ascertained, as in many cases the only information a farmer could give was that he had paid a garage man a certain amount for filling up his car with grease, and often the charge made was more for the labor involved than for the grease used.

The average number of miles per quart of motor oil for these trucks is shown in table 30. The largest quantity of oil was used by the new trucks and the ones that had been used for over two years, while the trucks that had been owned for from one to twenty-four months used the least oil (table 29).

TABLE 30. AVERAGE CONSUMPTION OF LUBRICANTS BY 70 TRUCKS

Size of trucks	Number of trucks	Average size (tons)	Total miles traveled	Motor oil			Grease (total cost)	Cost of lubrication per mile
				Gallons	Value	Miles per quart		
Under 1 ton	33	0.55	3,811	15.36	$13.00	62.0	$4.06	$0.004
1 ton	24	1.00	3,574	31.11	27.62	28.7	1.35	0.008
Over 1 ton	13	1.70	4,531	37.76	36.75	30.0	5.57	0.009
Total and average	70	0.91	3,863	24.92	$22.43	38.8	$2.33	$0.006

This agrees with the common knowledge that older machines usually require more oil, but will go longer without oiling, than new machines with tight bearing parts. The writer observed that there was a general tendency among owners of new trucks, and especially with men who had had no previous experience with automobile motors, to use an excess of oil

(due probably to the fact that they wanted to be sure to use enough), and that a great deal of oil was lost by leakage from the motors of old trucks. These two facts would tend to give a low mileage per quart of oil for both the new and the very old trucks.

Interest

Interest on the money invested is one of the costs of operating a truck. In figuring the costs of operation, interest was charged at 6 per cent on the average value of the trucks at the beginning and at the end of the year. This item amounted to $39.25, or 9.9 per cent of the total cost of truck operation.

Truck licenses

The average amount paid for a license was $12.29. The laws of New York required, at the time when the survey was taken, that every motor vehicle owned within the State be licensed by the State Commission of Highways, and the charge made for a truck license was in proportion to the maximum load which the truck was licensed to carry. Some trucks were licensed to carry loads in excess of the capacity for which they had been rated by the companies building them, and some others were not licensed to carry loads as large as their rated capacity. In this work, wherever reference is made to a particular size of truck, capacity as rated by the manufacturer, and not licensed capacity, is meant.

Insurance

No liability, collision, or theft insurance was carried on any of the 70 trucks included in the survey work, and only six owners had any special insurance against fire. The cost per truck of fire insurance for the trucks that were insured was $9.42. The average cost of this item for the 70 trucks was 81 cents.

Use of buildings for housing trucks

In determining the total annual cost of truck operation, a charge should be made for the use of the building in which the truck is housed. This charge should cover the costs of maintaining such a building. Results of cost-account investigations show that the average annual cost, in addition to interest, of maintaining farm buildings is approximately 4 per cent of their inventory value. This 4 per cent covers taxes, depreciation, repairs, and other costs of maintenance. In determining the cost of truck operation in this study, a charge of 10 per cent of the value of the buildings used by trucks was made, to cover the interest on such buildings at 6 per cent and the other costs of maintenance. This charge amounted to $6.71 per truck.

Cost of truck driver

Each of the truck owners in the dairy section of southern New York from whom a survey record was obtained, was asked how much he paid per month to the person who drove his truck, or how much it would cost to hire a person equally as good to take the place of the driver in case the owner or another unpaid member of his family was doing the driving. The total number of hours worked per month by the truck driver, and the

value of board or other farm products and privileges furnished to the driver in addition to cash wages, were also ascertained.

The truck owner was asked further what he would have to pay a man equally as good for all other farm work except truck driving. The cost per month and per hour of unpaid and of hired drivers, including the value of board and other farm products and privileges furnished, and the cost to hire men equally as good for all ordinary farm work, are shown in table 31:

TABLE 31. COST OF TRUCK DRIVERS

	Unpaid drivers	Hired drivers	Total and average
Number of trucks	65	5	70
Hours worked per month	247	259	248
Cost to hire for ordinary farm work:*			
Per month	$65.38	$60.60	$65.04
Per hour	$0.265	$0.234	$0.262
Cost to hire for driving:			
Per month	$68.24	$73.60	$68.63
Per hour	$0.276	$0.284	$0.277
Extra cost because of truck:			
Per month	$2.86	$13.00	$3.59
Per hour	$0.011	$0.05	$0.015

* This cost includes value of board and other farm products, and privileges furnished to drivers.

The average cost per month of the unpaid drivers was $68.24, or $2.86 per month more than the cost to hire persons equally as good for ordinary farm work. Hired drivers received $73.60 per month, or $13 more than the cost to hire other farm hands. The cost for all drivers was $68.63 per month, or 27.7 cents per hour. This was $3.59 per month and 1.5 cents per hour above the average figure for which the owners of the trucks estimated they could hire men equally as capable for doing all kinds of farm work except driving. The average cost of driver per truck was $128.98.

TOTAL COST, AND COST PER MILE, OF TRUCKS AND DRIVERS

The various items of cost of operating trucks of different sizes, and the cost of truck drivers, are shown in table 32. The average costs per mile, of trucks and of drivers, are shown in table 34. As would be expected, the cost per mile increased with the size of trucks, but the increase was not in direct proportion.

A better measure of the cost of truck transportation than cost per mile is cost per ton-mile. A ton-mile represents hauling equivalent to moving one ton a distance of one mile. If a truck moves five tons one mile, it accomplishes five ton-miles of work. If it hauls one ton five miles, it also does five ton-miles of work.

Some of the trucks were used to take the place of a passenger car. Of the total miles driven, 11 per cent was for this purpose. The cost per mile of operating a truck was found by dividing the total cost of operation by the total miles driven, including both hauling and passenger use. The cost per ton-mile was found as follows: if 10 per cent of the total mileage of a particular truck was for passenger use and 90 per cent was for actual

TABLE 32. AVERAGE ANNUAL COSTS OF TRUCK OPERATION
(70 trucks in Broome, Chenango, and Delaware Counties)

	Size of trucks						Tota and average
	½ ton	¾ ton	1 ton	1½ tons	2 tons	2½ tons	
Number of trucks	27	6	24	10	1	2	70
Average value	$343.15	$745.83	$643.00	$1,152.50	$850.00	$2,125.00	$654.10
Costs:							
Depreciation	$46.67	$124.99	$118.50	$195.00	$100.00	$250.00	$105.77
Interest	20.59	44.75	38.56	69.15	51.00	127.50	39.25
Insurance	0.00	0.25	0.42	1.50	18.00	6.00	0.81
License	10.21	13.33	10.87	16.88	25.00	25.00	12.29
Cash repairs	76.09	66.56	98.02	97.76	139.00	259.00	92.01
Farm labor repairing*	8.95	3.66	7.72	11.93	0.00	1.20	8.15
Fuel†	78.45	109.41	101.64	85.55	622.83	339.04	105.29
Motor oil†	13.07	12.69	27.63	20.93	129.75	69.38	22.43
Grease	1.81	1.50	1.35	5.90	2.40	5.50	2.33
Use of buildings	6.13	9.42	6.58	7.95	3.50	3.50	6.71
Total cost without driver	$261.97	$386.56	$411.29	$512.55	$1,091.48	$1,086.12	$395.04
Cost of driver	99.87	97.02	128.15	170.87	387.52	340.39	128.98
Total cost of truck and driver	$361.84	$483.58	$539.44	$683.42	$1,469.00	$1,426.51	$524.02

* The average number of hours of farm labor spent in repairing trucks was 31.3.
† The average amounts of fuel and of motor oil used by the different sizes of trucks are shown in tables 28 and 30.

trucking work, then 90 per cent of the total annual cost was considered to be the cost for hauling, and this figure divided by the number of ton-miles gave the cost per ton-mile. The cost per ton-mile for the average of these trucks is shown in table 33, and the cost per ton-mile for trucks of different sizes is shown in table 34.

TABLE 33. AVERAGE COST OF TRUCK OPERATION

Number of trucks	70
Average size, in tons	0.91
Truck cost	$395.04
Cost of driver	$128.98
Total cost of truck and driver	$524.02
Miles driven	3,863
Truck cost per mile	$0.102
Cost of driver per mile	$0.034
Total cost per mile	$0.136
Cost of truck for hauling	$351.64
Cost of driver for hauling	$114.79
Total hauling cost	$466.43
Ton-miles	2,165.6
Truck cost per ton-mile	$0.162
Cost of driver per ton-mile	$0.053
Total cost per ton-mile	$0.215

The average size of load carried by the ½-ton trucks was 671 pounds, and, while it cost only 6.5 cents per mile, exclusive of the cost of the driver, to operate these ½-ton trucks, it cost 30.8 cents per ton-mile of hauling done by them. The cost per mile, exclusive of cost of driver, of the 1-ton

TABLE 34. TRUCK COSTS PER MILE AND PER TON-MILE, 70 TRUCKS

Size of trucks	Number of trucks	Average miles driven	Average ton-miles	Cost per mile			Cost per ton-mile		
				Truck	Driver	Total	Truck	Driver	Total
½ ton	27	4,011	580.4	$0.065	$0.025	$0.090	$0.308	$0.118	$0.426
¾ ton	6	2,910	1,606.2	0.133	0.033	0.166	0.224	0.056	0.280
1 ton	24	3,574	2,425.2	0.115	0.036	0.151	0.159	0.050	0.209
1½ tons	10	3,482	3,168.4	0.147	0.049	0.196	0.160	0.054	0.214
2 tons	1	11,072	11,301.6	0.099	0.034	0.133	0.097	0.034	0.131
2½ tons	2	6,504	12,547.1	0.167	0.052	0.219	0.087	0.027	0.114
Total and average	70	3,863	2,165.6	$0.102	$0.034	$0.136	$0.162	$0.053	$0.215

trucks was 11.5 cents, but their average cost per ton-mile was only 15.9 cents. The average cost per mile, exclusive of cost of driver, for all trucks was 10.2 cents, and the cost per ton-mile was 16.2 cents.

RELATION OF AMOUNT OF HAULING TO COST PER MILE AND PER TON-MILE OF TRUCKS, EXCLUSIVE OF DRIVER

One way to reduce the cost per mile of operating a truck is to drive it more miles; one way to reduce the cost per ton-mile is to do more hauling. Certain of the costs of operating a truck are not affected by the extent to which the truck is driven. Fuel, lubrication, depreciation, and repairs increase with the amount of work done; but interest, insurance, license, and storage are the same whether the truck is driven a thousand miles or ten thousand. For this reason the men who had a small amount of work to do with their trucks had a relatively high cost per mile and per ton-mile.

The relation of the total number of miles that trucks were driven, to the cost per mile of operation and other factors, is shown in table 35. The average cost of operating the 18 trucks that were driven less than 2500

TABLE 35. RELATION OF TOTAL MILES DRIVEN, TO COST PER MILE AND PER TON-MILE EXCLUSIVE OF DRIVER

Miles driven	Number of trucks	Average per truck						
		Total miles driven	Size of truck in tons	Total annual cost*	Cost per mile	Total ton-miles	Hauling cost*	Cost per ton-mile
Under 2500	18	1,557	0.82	$311.50	$0.200	638.7	$294.52	$0.461
2500 to 5000	34	3,565	0.92	385.91	0.108	1,839.5	335.10	0.182
Over 5000	18	6,734	1.00	495.79	0.074	4,308.4	440.01	0.102
Total and average	70	3,863	0.91	$395.04	$0.102	2,165.6	$351.64	$0.162

* For explanation of hauling cost and total annual cost, see page 30.

miles was $311.50. The average size of these trucks was 0.82 ton, and it cost 20 cents per mile, exclusive of driver, to operate them. The average sizes of the trucks in the two groups that were driven from 2500 to 5000 miles and over 5000 miles, respectively, were 0.92 ton and 1 ton. These trucks were larger, and it cost more per year to operate them than to operate the smaller trucks; but, since they were driven so many more miles, their costs per mile were relatively low, being 10.8 cents and 7.4

cents, respectively, as compared with 20 cents for the 18 trucks included in the first group.

The cost per ton-mile of operating the trucks included in table 35 decreased much more rapidly with increased mileage than did their cost per mile. The trucks that were driven the greatest number of miles also did the greatest number of ton-miles of hauling and had the lowest cost per ton-mile. The relative costs per ton-mile of operating trucks of different sizes are shown in table 34, and sorting the trucks into three groups according to the number of ton-miles hauled (table 36) shows again the economy

TABLE 36. RELATION OF TON-MILES OF HAULING TO COST PER TON-MILE, EXCLUSIVE OF DRIVER

Ton-miles	Number of trucks	Average per truck						
		Total ton-miles	Size of truck in tons	Total annual cost	Total hauling cost	Total miles driven	Cost per mile	Cost per ton-mile
Under 800	24	403.6	0.64	$243.18	$177.69	2,535	$0.096	$0.440
800 to 2500	27	1,317.2	0.83	404.44	356.21	4,166	0.097	0.270
Over 2500	19	5,596.7	1.38	573.50	564.88	5,112	0.112	0.101
Total and average	70	2,165.6	0.91	$395.04	$351.64	3,863	$0.102	$0.162

of having enough work for a truck to do. More miles or more ton-miles will usually mean a lower cost for each mile or ton-mile of work done.

EFFECT OF OVERLOADING TRUCKS

The weight of each load hauled was ascertained for each of the trucks included in the survey work. The average weight of load was calculated for each truck, and was found to be less than the rated capacity for 48 trucks and more than the rated capacity for 22 trucks.

The average sizes of loads hauled by these two groups, and their repair costs and costs per ton-mile of truck and driver, are shown in table 37. The overloaded trucks were estimated to last just as long as those that

TABLE 37. RELATION OF OVERLOADING TRUCKS TO COST OF OPERATION AND OTHER FACTORS

(70 trucks in southern New York)

	Average truck loaded above rated capacity	Average truck loaded below rated capacity
Number of trucks	22	48
Average size, in tons	1.1	0.8
Weight of load hauled, in pounds	2,725	1,138
Days per annum laid up for repairs	2.5	0.8
Estimated length of life, in years	8.4	8.25
Cost of repairs	$128.83	$87.03
Total cost of hauling	$431.00	$315.27
Ton-miles of hauling	3,921.6	1,360.7
Truck cost per ton-mile	$0.11	$0.232
Cost of driver per ton-mile	$0.036	$0.075
Total cost per ton-mile	$0.146	$0.307

were not overloaded, but they were laid up for repairs when needed more than three times as long as the trucks hauling the smaller loads. The men who overloaded their trucks had larger repair bills than the other truck owners, but they had larger trucks and did almost three times as much hauling, and their cost per ton-mile of both truck and driver was less than half that of the 48 truck owners who underloaded.

Effect of overloading the Ford 1-ton truck

Of the 20 owners of Ford 1-ton trucks, 7 were overloading and 13 were underloading. The cost of repairs and the total cost of truck operation were larger for the overloaded Ford trucks, but their cost per ton-mile of hauling was only a little over half that of the underloaded trucks (table 38).

TABLE 38. RELATION OF OVERLOADING THE FORD 1-TON TRUCK, TO COST OF OPERATION AND OTHER FACTORS

	Average overloaded truck	Average underloaded truck	Total and average
Number of trucks	7	13	20
Average weight of load, in pounds	2,504	1,250	1,689
Miles driven	3,545	3,446	3,480
Ton-miles	2,958	1,694	2,136
Days per annum laid up for repairs	0.6	0.9	0.8
Estimated length of life, in years	6.5	6.9	6.8
Value of truck at beginning of year	$572	$583	$579
Depreciation	$86.43	$116.46	$106.45
Cost of repairs	$162.29	$98.30	$120 69
Total truck cost exclusive of driver	$413.40	$390.71	$398 65
Hauling cost*	$366.57	$370.55	$369.15
Truck cost per mile, exclusive of driver	$0.117	$0.113	$0.115
Truck cost per ton-mile	$0.124	$0.219	$0.173
Cost of driver per ton-mile	$0.045	$0.065	$0.055
Total cost per ton-mile	$0.169	$0.284	$0.228

* For explanation of hauling cost, see page 30.

These results do not necessarily prove that it pays a farmer to overload his truck, but they do show that, from an economic standpoint, having a large amount of hauling for a truck is of more importance than avoiding overloading. The men who overloaded their trucks had a low cost of hauling per ton-mile, not primarily because they overloaded, but because they had a large amount of hauling to do, and worked their trucks more nearly to full capacity than did the truck owners who underloaded.

COMPARATIVE COSTS OF OPERATING TRUCKS BOUGHT NEW AND TRUCKS BOUGHT SECOND-HAND

Of the 70 trucks in the dairy section of southern New York, 29 were purchased second-hand or built from passenger automobiles and 41 were purchased new. The relation of depreciation and repairs on these trucks to their initial cost and their total annual cost is shown in table 39. The actual amount of the charge for depreciation, repairs, and other items of

TABLE 39. RELATION OF DEPRECIATION AND REPAIRS TO INITIAL COST AND TOTAL ANNUAL COST OF NEW AND OF SECOND-HAND TRUCKS

How acquired	Number of trucks	Per cent depreciation is of initial cost	Per cent repair cost is of initial cost	Per cent depreciation is of annual cost	Per cent repair cost is of annual cost
Bought new	41	12.7	9.1	31.7	22.7
Bought second-hand or built from automobiles	29	10.5	17.0	18.3	29.8
Total and average	70	12.0	11.4	26.8	25.4

expense, together with other factors, is shown in table 40. The total cost of operating the 29 second-hand trucks was $352.57, as compared with $425.08 for the trucks bought new.

TABLE 40. COST, EXCLUSIVE OF DRIVER, OF OPERATING TRUCKS BOUGHT NEW AND TRUCKS BOUGHT SECOND-HAND

	Bought new	Bought second-hand
Number of trucks	41	29
Average size, in tons	0.95	0.87
Present age, in years	2.22	4.75
Initial cost	$1,066.00	$617.41
Value at beginning of year	$853.00	$500.00
Additional years of service	5.2	4.0
Average life of truck	7.42	8.75
Days per annum laid up for repairs	1.4	1.1
Costs:		
Depreciation	$134.85	$ 64.66
Interest	47.16	28.06
Insurance	0.65	1.03
License	12.09	12.57
Cash repairs	90.93	93.54
Farm labor repairing	5.69	11.64
Gasoline	105.52	104.97
Lubrication	21.27	29.67
Use of buildings	6.91	6.43
Total cost	$425.08	$352.57
Per cent depreciation is of initial cost	12.7	10.5*
Per cent depreciation is of annual cost	31.7	18.3
Per cent repair cost is of initial cost	9.1	17.0*
Per cent repair cost is of annual cost	22.7	29.8
Miles traveled	3,589	4,252
Cost per mile, exclusive of driver	$0.118	$0.083

* Initial cost to present owner.

Statements have frequently been made that the high cost of repairs on a second-hand truck will offset the low depreciation on such a truck, and that the sum of depreciation and repairs will be the same on old as on new trucks. The depreciation on the 41 trucks averaging 2.22 years old was

higher than that on the 29 second-hand trucks which had been in use for 4.75 years, but the repairs on the older trucks were only a little more than the repairs on the newer ones. The sum of depreciation and repairs on the 41 trucks bought new was $231.47, and on the average of the second-hand ones was $169.84.

The average cost per truck for gasoline was about the same on the new and the second-hand machines, but the second-hand trucks were driven more miles, making the gasoline cost per mile less. Lubrication costs were considerably higher on the second-hand trucks, but the charge for interest on these was enough lower to more than offset the higher lubrication costs.

The average cost per mile for the second-hand trucks was 8.3 cents, as compared with 11.8 cents for the 41 trucks bought new and having an average age of 2.53 years less than the trucks bought second-hand. The average number of days that the newer trucks were laid up for repairs was 1.4, as compared with 1.1 for the 29 second-hand machines.

These results should not be taken as meaning that it would always pay a farmer better to buy a second-hand truck instead of a new one. The probable service that any machine will give and the price asked for it, together with the work to be done by it, should determine its worth to a prospective buyer. A farm machine which has been used for only one year and has had good care, will usually sell for less than its actual worth as determined by the service it will give.

Due to the high depreciation on new machinery, men who buy new trucks have a high cost of operation for the first year or two of use. In some cases when delays due to a truck breaking down would be very expensive, it might be better to pay this higher cost of operation rather than run the risk of such delays.

TRUCK DRIVERS

Information as to who usually drove the trucks was asked for on the questionnaire used in this study, and a tabulation of the replies of 522 truck owners to this question is shown in table 41. In 335 cases the owner was reported as being the usual driver. About one truck in eight was being operated by a son of the owner, and, in all, 436 trucks were being driven by owners or by owners' sons.

TABLE 41. DRIVERS OF 522 FARM MOTOR TRUCKS

Person driving truck	Number of trucks driven by each class of drivers	Per cent of total number of all trucks
Owner	335	64.2
Owner's son	69	13.2
Owner and son	32	6.1
Owner's daughter	2	0.4
Owner's wife	4	0.8
Owner and other family help	15	2.9
Hired help	36	6.9
Owner and hired help	14	2.7
Others	15	2.9
Total	522	

Very few trucks were being operated by hired labor. Only 36 men reported that their trucks were usually driven by hired labor, and 457 reported that their trucks were being driven by the owner or some member of the owner's family.

The number of owners of the different sizes of trucks, who reported that they were hiring special help aside from regular farm labor, is shown in table 42. Only 1 man with a truck smaller than the 1-ton size was employing special help for driving, while 5 of the owners of 1-ton trucks and 6 of the owners of trucks larger than 1 ton were hiring such help. The average amount per month above the wages of regular farm labor, paid for a driver by men who hired this help, was $13.

TABLE 42. NUMBER OF TRUCK OWNERS HIRING SPECIAL HELP FOR DRIVING

Size of truck	Number of owners reporting	Number hiring special help	Number not hiring special help
Under 1 ton	71	1	70
1 ton	112	5	107
Over 1 ton	51	6	45
Total	234	12	222

The average number of miles which the trucks in the dairy region of southern New York were driven by their owners and by other persons, is shown in table 43. With trucks of less than 1-ton capacity, owners themselves were doing 81 per cent of the driving; with 1-ton trucks, owners were doing 73 per cent of the driving; and with trucks larger than 1 ton, owners were doing 50 per cent of the driving. All of the $\frac{1}{2}$- and $\frac{3}{4}$-ton trucks were being driven by the owners or by other unpaid family labor, while one-fourth of the driving with trucks larger than 1 ton was done by hired help.

TABLE 43. AVERAGE NUMBER OF MILES DRIVEN BY DIFFERENT DRIVERS
(70 trucks, included in table 32)

	Size of truck			Total and average
	Under 1 ton	1 ton	Over 1 ton	
Number of trucks	33	24	13	70
Average size, in tons	0.55	1.00	1.69	0.91
Average number of miles driven	3,811	3,574	4,531	3,863
Miles driven by:				
Owner	3,072	2,608	2,284	2,766
Owner's son	550	765	1,106	727
Owner's daughter	16	.....	.....	8
Owner's wife	173	.....	.....	82
Hired help	.....	201	1,141	280

Hired help did about the same percentage of the total driving with the trucks in the dairy section, as was done by hired help with the trucks which were scattered thruout the State. Truck owners in the dairy section did about the same amount of driving as the owners of trucks in other sections, and other members of the family did more. This is probably due largely to the fact that family labor does a greater part of the total farm work on a dairy farm than on a general crop and stock farm. Women and boys who may not be able to take a man's place in the field, can frequently make the daily trip to the milk station as quickly and as easily as the farm operator or a highly paid hired man.

There seemed to be a general tendency for more of the driving of the larger trucks to be done by some one other than the owner. Probably this is due principally to the fact that a considerable proportion of these trucks were found on the larger farms, on which there would naturally be more persons available to act as drivers.

Truck owners whom the writer met in this work expressed a variety of opinions concerning the desirability of having truck driving done by hired labor. Some men who had a natural liking for good horses, and on this account probably gave their teams a little better care than the average farmer, felt that their hired help could be trusted with trucks as well as or better than they could with horses. Other farmers — and usually these were younger men, who had had more experience with automobiles and trucks — said that they could trust their help with teams better than with trucks. The relative mechanical ability of truck owners and of the hired men whom they happened to have at the time, probably formed for the most part the basis of these opinions.

To say whether or not it is advisable to have hired labor drive a truck is like saying whether or not hired men are good teamsters. The best teamster on one farm may be the owner of the place, and on the next farm the hired man or the owner's son; and the best truck driver may not always be the man who owns the truck. It requires a certain amount of ability to drive efficiently either a team or a truck.

ROAD HAULING DONE WITH TRUCKS

The average amount of road hauling which 251 truck owners did for their own farms is shown in table 44. On an average, each truck owner handled

TABLE 44. AMOUNT OF ROAD HAULING WITH TRUCKS DONE BY 251 TRUCK OWNERS FOR THEIR OWN FARMS

Size of trucks	Number of trucks	Number of loads per truck	Tons hauled per truck	Miles of hauling per truck	Ton-miles per truck
½ ton	65	219.2	75.6	1,124.9	467.2
¾ ton	14	232.7	184.3	1,334.4	1,085.0
1 ton	116	164.6	147.9	908.7	893.6
1¼ tons	5	135.5	186.9	670.8	1,192.6
1½ tons	24	194.4	332.5	1,406.8	2,283.9
2 tons	18	225.1	545.3	1,346.4	3,273.6
Over 2 tons	9	119.2	510.0	1,495.3	5,722.5
Total and average	251	187.5	191.1	1,083.8	1,276.5

187.5 loads and 191.1 tons of material for his own farm, in addition to doing a small amount of custom work for neighbors.

The kinds of material hauled and the number of tons of each kind are shown in table 45. Crops made up 54.4 per cent of the total material hauled, and the ton-miles of crop hauling represented 57.9 per cent of the total ton-miles. Milk was the second largest item hauled, and made up 24.5 per cent of the total material hauled and 21.6 per cent of the total ton-miles of hauling. The average truck hauled more loads of milk than of crops, but the average load of crops hauled was larger than the average load of milk.

TABLE 45. MATERIALS HAULED ON ROAD WITH TRUCKS, BY 251 TRUCK OWNERS FOR THEIR OWN FARMS

Material hauled	Number of owners reporting this kind of hauling	Amount of hauling per truck			
		Loads	Tons	Miles	Ton-miles
Crops	176	66.0	103.9	469.0	739.7
Milk	80	81.5	46.9	352.3	275.6
Feed	82	10.8	8.5	62.4	61.5
Commercial fertilizer	41	1.6	3.4	8.5	18.1
Lime	20	1.0	1.2	6.6	7.6
Manure	9	3.2	6.8	19.1	55.8
All else	98	23.4	20.4	165.9	118.2
Total	.....	187.5	191.1	1,083.8	1,276.5

TRUCK HAULING DONE BETWEEN BARN AND FIELDS

Of the 251 truck owners included in table 44, 73 did some hauling with their trucks between barn and fields. The amount of this kind of hauling done by owners of different sizes of trucks is shown in table 46, and the

TABLE 46. TRUCK HAULING, PER TRUCK, BETWEEN BARN AND FIELDS, 251 TRUCK OWNERS

Size of trucks	Number of trucks	Amount of hauling per truck			
		Loads	Tons hauled	Miles of hauling	Ton-miles
½ ton	65	9.1	3.5	3.4	1.3
¾ ton	14	33.0	24.9	18.5	15.6
1 ton	116	17.8	15.9	5.6	5.1
1¼ tons	5	19.0	19.2	4.8	4.8
1½ tons	24	24.3	28.6	15.7	19.0
2 tons	18	19.4	34.9	14.6	28.6
Over 2 tons	9	6.9	3.3	2.6	1.2
Total and average	251	16.8	15.5	7.3	7.7

materials hauled are shown in table 47. The ton-miles of truck hauling between barn and fields was less than one per cent of the number of ton-miles of hauling done by the trucks on the road.

TABLE 47. MATERIALS HAULED BETWEEN BARN AND FIELDS, 251 TRUCK OWNERS

Material hauled	Amount of hauling per truck			
	Loads	Tons	Miles	Ton-miles
Crops	13.6	12.9	5.3	5.2
Fertilizer	0.4	0.4	0.3	0.3
Manure	0.6	1.0	0.2	0.2
Feed	0.1	0.1	0.1	0.1
All else	2.1	1.1	1.4	1.9
Total	16.8	15.5	7.3	7.7

ROAD HAULING DONE WITH HORSES BY TRUCK OWNERS

Of the 251 truck owners whose questionnaires were included in this study, 244 reported concerning the amount of horse road-hauling which they had done in the past year. Of this number, 128 still did some road hauling with horses, and 116 had done all their road hauling with trucks. The average amount of horse road-hauling for the 244 men who reported this information is shown in table 48. Comparing this table with table 44, it is seen that only 5.3 per cent of the total road hauling reported was done with horses.

TABLE 48. ROAD HAULING DONE WITH HORSES, 244 TRUCK OWNERS

Size of trucks	Number of farms	Number of loads per farm	Total tons hauled	Miles of hauling	Ton-miles per farm
½ ton	62	31.0	33.8	87.7	108.2
¾ ton	14	39.8	19.6	140.9	62.0
1 ton	114	13.7	13.5	50.2	48.8
1¼ tons	5	8.6	15.6	26.5	46.8
1½ tons	24	5.3	7.6	31.9	47.8
2 tons	16	68.0	96.1	93.0	150.4
Over 2 tons	9	8.9	16.4	27.2	47.4
Total and average	244	22.0	24.0	64.6	71.1

The kinds and amounts of the different materials hauled with horses are shown in table 49. Crops represented 44.2 per cent and milk 15 per cent of the total material hauled with horses.

A greater proportion of the milk than of the crops from these farms was hauled with trucks. The number of tons of the various materials hauled

TABLE 49. MATERIALS HAULED ON THE ROAD WITH HORSES, 244 TRUCK OWNERS

Material hauled	Number of owners reporting	Amount of hauling per farm			
		Loads	Tons	Miles	Ton-miles
Crops	51	8.0	10.7	18.7	29.5
Milk	27	7.3	3.6	26.9	14.5
Feed	25	1.2	1.5	5.0	6.2
Fertilizer	11	0.3	0.5	0.6	1.0
Lime	5	0.1	0.3	0.7	1.6
Manure	8	1.5	1.8	2.4	3.8
All else	49	3.6	5.6	10.3	14.5
Total	.....	22.0	24.0	64.6	71.1

to and from these farms with trucks and with horses is shown in table 50, and the average weight of loads hauled with trucks and with horses is shown in table 51.

TABLE 50. TONS, PER FARM, OF DIFFERENT MATERIALS HAULED WITH TRUCKS AND WITH HORSES, 251 TRUCK OWNERS*

Material hauled	Total tons per farm	Tons hauled with trucks	Tons hauled with horses
Crops	114.6	103.9	10.7
Milk	50.5	46.9	3.6
Feed	10.0	8.5	1.5
Fertilizer	3.9	3.4	0.5
Lime	1.5	1.2	0.3
Manure	8.6	6.8	1.8
All else	26.0	20.4	5.6
Total	215.1	191.1	24.0

* Hauling between barns and fields not included.

TABLE 51. AVERAGE WEIGHT OF LOADS HAULED ON THE ROAD WITH TRUCKS AND WITH HORSES, 244 TRUCK OWNERS

Material hauled	Weight of load hauled (in pounds)	
	With trucks	With horses
Crops	3,137	2,665
Milk	1,174	989
Feed	1,593	2,596
Fertilizer	4,256	3,581
Lime	2,364	4,310
Manure	4,281	2,472
All else	1,742	3,049
Average	2,052	2,180

CUSTOM TRUCK HAULING

Of the 251 truck owners from various parts of the State included in this study, 89 reported that they did some road hauling with their trucks for other persons, 150 reported no custom truck hauling, and 12 did not report on this point. The average amount received for this work by the farmers who reported this information was $252.04. The average amount of custom hauling per truck is shown in table 52, and the materials hauled are shown in table 53. Custom truck hauling represented only 12.5 per cent of the total road hauling with trucks reported by these 251 farmers.

TABLE 52. CUSTOM HAULING PER TRUCK DONE BY 239 TRUCK OWNERS

Size of trucks	Number of trucks	Amount of custom hauling per truck		
		Tons	Miles	Ton-miles
½ ton	64	0.9	24.8	5.9
¾ ton	12	36.7	315.5	215.5
1 ton	109	19.2	261.3	138.4
1¼ tons	5	1.4	9.9	8.8
1½ tons	23	33.5	214.5	323.4
2 tons	18	42.6	173.0	568.9
Over 2 tons	8	47.3	153.4	972.2
Total and average	239	18.9	180.7	182.2

The average amount received per ton-mile for custom truck hauling was 34.3 cents, as compared with 21.5 cents for the cost per ton-mile of truck and driver as shown in table 33. Much of this custom hauling was done at a time when the truck owners were doing some of their own road hauling. If a farmer is making a daily trip with his truck to a milk station with ten cans of milk from his own dairy, the hauling of ten additional cans for a neighbor would probably not double his cost of truck operation. For

TABLE 53. MATERIALS HAULED AS CUSTOM HAULING, 239 TRUCK OWNERS

Material hauled	Number of owners reporting	Amount of custom hauling per truck			
		Loads	Tons	Miles	Ton-miles
Crops	31	2.3	4.6	27.8	51.5
Milk	13	10.1	6.8	55.8	39.0
Feed	10	1.6	1.9	16.4	23.7
Fertilizer	4	0.1	0.4	1.6	10.4
Lime	3	0.1	0.1	0.5	0.7
Manure	1	0.1	0.1	0.3	0.9
All else	27	3.8	5.0	78.3	56.0
Total	89	18.1	18.9	180.7	182.2

this reason, some farmers were doing truck hauling for less than the actual cost per ton-mile of operating their trucks.

Of 33 truck owners who reported this information, 11 did all of their custom hauling when they were doing hauling for their own farms, and 18 did none of their custom work in this way. The other 4 did a part of their custom hauling when doing hauling for themselves.

TIME REQUIRED FOR ROAD HAULING WITH TRUCKS AND WITH HORSES

Each truck owner from whom a record was obtained was asked to give the amount of time required to do the various kinds of road hauling that he did with his truck, and also the number of horses and the time required to do the same hauling with horse and wagon. A comparison of the actual hours required to do the road hauling on 251 farms, and the hours which these men estimated that it would have taken to do this hauling with horses, is shown in table 54:

TABLE 54. TIME REQUIRED TO DO ROAD HAULING WITH TRUCKS, AND ESTIMATE OF TIME REQUIRED TO DO THE SAME HAULING WITH HORSES

Size of trucks	Number of trucks	Total ton-miles	Hours of horse labor required	Hours of man labor required		
				With trucks	With horses	Per cent hours with trucks are, of hours with horses
½ ton	65	30,366.7	64,054	18,587	40,894	45.5
¾ ton	14	15,190.4	21,507	4,295	10,716	40.1
1 ton	116	103,651.8	153,369	31,587	78,138	40.4
1¼ tons	5	5,963.0	5,318	994	2,659	37.4
1½ tons	24	54,812.7	45,342	8,307	22,496	36.9
2 tons	18	58,924.9	65,452	8,717	32,726	26.6
Over 2 tons	9	51,502.7	32,603	3,062	13,119	23.3
Total	251	320,412.2	387,645	75,549	200,748	37.6

The per cent which the number of hours required to do the road hauling with trucks represented, of the hours which the truck owners estimated would have been required to do the same hauling with horses, varied from 23.3 for the largest trucks to 45.5 for the smallest ones. The 251 truck owners estimated that they were doing their total road hauling in 37.6 per cent of the time that would have been required to do the same hauling with horses.

The number of hours required for hauling the different kinds of materials with trucks and with horses is given in table 55. Crops were hauled with trucks by these farmers in 37.8 per cent of the time required with horses, but feed hauling with trucks required 48.2 per cent of the time required with horses. This can perhaps be accounted for by the fact that, in hauling crops and milk, these farmers were hauling almost the same size of load with trucks as they would have hauled with horses, while, had they hauled their feed with horses, they would have hauled larger

TABLE 55. HOURS REQUIRED FOR HAULING DIFFERENT KINDS OF MATERIALS WITH TRUCKS AND WITH HORSES

Material hauled	Number of owners reporting	Total ton-miles	Average weight of load, in pounds		Hours of horse labor required	Hours of man labor required		
			With trucks	With horses		With trucks	With horses	Per cent hours with trucks are, of hours with horses
Crops	176	185,655.5	3,151	3,138	170,868	31,429	83,063	37.8
Milk	80	69,179.0	1,151	1,159	137,395	27,269	74,773	36.5
Feed	82	15,447.5	1,575	2,000	18,902	4,618	9,575	48.2
Fertilizer	41	4,534.6	4,240	3,698	3,761	649	1,873	34.7
Lime	20	1,917.7	2,364	2,508	3,056	449	1,528	29.4
Manure	9	14,002.0	4,281	3,466	11,948	1,587	5,974	26.6
All else	98	29,675.9	1,741	2,018	41,715	9,548	23,962	39.8
Total and average	.....	320,412.2	2,038	2,093	387,645	75,549	200,748	37.6

loads. A common practice among the farm-truck owners interviewed in this study is to haul their purchased feed in small quantities on their return trips from a milk station or a creamery; if they were hauling with horses, they would make a special trip for feed and would haul a larger load. More feed is used by farmers in winter than in summer, and a period of snow and good sleighing, which would tend to increase the size of loads that could be hauled with teams, would decrease the size that could be hauled with trucks. These two facts may account for the less saving of time in hauling feed with trucks as compared with hauling crops and milk.

Size of loads hauled with truck and with horses

The average sizes of loads hauled by owners of the different sizes of trucks, and the sizes of loads they would have hauled if they had used horses, are shown in table 56. There was very little difference in the average size of all loads hauled with trucks and with horses, but the owners of the smaller sizes of trucks were hauling smaller loads than they said

TABLE 56. AMOUNT OF ROAD HAULING WITH TRUCKS DONE BY 251 TRUCK OWNERS, AND HORSE HAULING DISPLACED

Size of trucks	Number of trucks	Tons hauled	Loads		Weight of load, in pounds	
			By truck hauling	By horses	By truck hauling	By horses
½ ton	65	4,913.5	14,246.0	12,008.6	690	818
¾ ton	14	2,580.2	3,258.0	2,818.3	1,584	1,831
1 ton	116	17,155.4	19,091.0	17,902.9	1,839	1,961
1¼ tons	5	934.5	677.5	679.0	2,754	2,753
1½ tons	24	7,980.3	4,665.5	4,962.4	3,421	3,216
2 tons	18	9,814.8	4,052.5	5,368.3	4,844	3,657
Over 2 tons	9	4,590.2	1,073.0	2,104.1	8,556	4,363
Total and average	251	47,968.9	47,063.5	45,843.6	2,038	2,093

they would have hauled with horses, and the owners of the larger trucks were hauling larger loads than they would have hauled with horses. This would indicate that there is a greater range in the sizes of trucks and truck loads than in the sizes of wagon loads.

HORSE AND MAN LABOR DISPLACED BY TRUCKS

Each farmer who furnished information for this study was asked how many more horses and how many more months of man labor he would need if he did not have a truck. The average number of horses and months of man labor which the farmers from different parts of the State who furnished this information said that their trucks displaced, are shown in table 57. The average truck displaced 1.8 horses and 4 months of man labor.

TABLE 57. AVERAGE NUMBER OF HORSES AND MONTHS OF MAN LABOR DISPLACED BY TRUCKS

Size of trucks	Extra horses needed		Additional months of man labor needed	
	Number of truck owners reporting	Average number of horses	Number of truck owners reporting	Average number of months
½ ton	57	1.3	45	2.4
¾ ton	10	2.1	10	4.2
1 ton	111	1.6	90	3.5
1¼ tons	5	2.1	4	6.8
1½ tons	19	2.5	16	5.0
2 tons	16	3.2	17	6.4
Over 2 tons	8	3.7	7	9.9
Total and average	226	1.8	189	4.0

COMPARATIVE COST OF TRUCK AND HORSE HAULING

One of the most frequent questions concerning motor trucks asked by farmers is, "How much does it cost to haul with a truck as compared with hauling with horses?" The costs of operating different sizes of trucks have already been given, in table 32. A comparison of the time required to do the same amount of hauling with trucks and with horses is shown in table 54. In order to compare the cost per mile or per ton-mile of truck and horse hauling, it is necessary to know the cost per hour of horse labor.

Cost-account investigational work indicated that the average cost per hour of horse labor on New York farms in 1921 was approximately 20 cents, and the average cost per horse hour of maintaining farm wagons was 5 cents. Assuming the cost of horse labor on the 70 farms in southern New York which were included in this study, to be 20 cents, and the cost of wagons to be 5 cents per horse hour, figures for the cost of horses and wagons for the hauling which the trucks did can be obtained.

The average number of hours that would have been required to do with horses the hauling done with the 70 trucks, and the cost of this labor

at 25 cents per horse hour (20 cents for horse labor and 5 cents for wagons), are shown in table 58. The cost of drivers for the horses is figured at the same rate as the cost of truck drivers, and the cost per ton-mile of hauling with trucks of different sizes is compared with what it would have cost to do the same hauling with horses.

TABLE 58. COMPARISON OF THE COSTS PER TON-MILE OF TRUCK AND HORSE HAULING

Size of trucks	Costs per ton-mile					
	Truck			Horses and wagons		
	Truck	Driver	Total	Horses and wagons	Driver	Total
½ ton.....	$0.308	$0.118	$0.426	$0.751	$0.431	$1.182
¾ ton.....	0.224	0.056	0.280	0.239	0.139	0.378
1 ton.....	0.159	0.050	0.209	0.228	0.130	0.358
1½ tons	0.160	0.054	0.214	0.222	0.139	0.361
2 tons.....	0.097	0.034	0.131	0.184	0.068	0.252
2½ tons	0.087	0.027	0.114	0.103	0.067	0.170
Average...	$0.162	$0.053	$0.215	$0.257	$0.146	$0.403

The average cost per ton-mile of truck hauling without drivers was 16.2 cents and the cost per ton-mile of horses and wagons without drivers was 25.7 cents; but, since the time required to do the hauling with horses was nearly three times as great, the cost per ton-mile of a driver for horses was 14.6 cents, as compared with 5.3 cents for trucks. It must of course be kept in mind that on farms where horses are required for other work, it would probably be possible to do this additional amount of road hauling at a lower cost per hour than is shown in table 58.

RELIABILITY OF TRUCKS

An important factor to be considered in deciding whether to invest in any machine is its reliability, or the amount of time that it is liable to be laid up for repairs when needed. Inability to use a motor truck is usually due to the truck being out of repair, or to roads being in bad condition because of snow or mud.

Effect of type of roads on length of time trucks could be used

Information concerning the kinds of roads on which each truck was usually driven was obtained, and the truck records were sorted into groups according to whether the trucks were used on unimproved, partly improved, or wholly improved roads. Any type of hard-surfaced road was considered as improved road. The average number of weeks lost on account of snow and mud by the different groups of trucks is shown in table 59.

The average truck owner who did all his driving on unimproved roads lost 8 weeks during the year because of weather conditions; the man who

TABLE 59. EFFECT OF TYPE OF ROADS ON WEEKS LOST BECAUSE OF WEATHER
(251 trucks used for one year or more)

	Type of roads			Total and average
	Unimproved	Partly improved	Improved	
Number of owners reporting	64	133	54	251
Average speed, in miles per hour:				
Loaded	13.1	14.6	14.7	14.2
Empty	17.4	17.7	17.7	17.6
Road hauling per truck:				
Ton-miles	880.5	1,191.8	1,954.6	1,276.5
Hours	279	297	336	301
Horse hauling displaced:				
Man hours	707	758	1,012	800
Horse hours	1,346	1,451	2,010	1,544
Average number of days per annum laid up for repairs	1.8	1.7	2.1	1.8
Average number of weeks lost due to weather conditions	8.0	5.0	3.3	5.4

drove on partly improved roads lost, on the average, only 5 weeks; and the truck driver who had all improved roads lost only 3.3 weeks. The average truck owner lost 5.4 weeks during the year because of bad roads.

Relation of amount of hauling done with trucks to number of days laid up for repairs

Type of road seemed to have little effect on the number of days that trucks were laid up for repairs when needed, but this factor did vary directly with the amount of hauling that was done with the truck (table 60).

TABLE 60. RELATION OF MILES OF HAULING TO LENGTH OF USEFULNESS OF TRUCKS
(150 trucks purchased new and used for one year or more)

Miles of hauling	Number of trucks	Average miles of hauling	Ton-miles	Average length of use	Average days per annum laid up for repairs
Under 600	47	329.0	446.6	9.5	1.4
600 to 1200	49	874.8	1,210.0	7.0	1.7
Over 1200	54	2,280.9	2,958.6	8.0	2.6
Total and average	150	1,210.0	1,600.3	8.1	1.9

There was little relation between the size of the trucks and the number of days they were laid up for repairs. The owners of large and of small trucks suffered about equally in this respect.

Truck parts giving the most trouble

Among the questions asked each truck owner was, what part of his truck had given him the most trouble. The replies to this question are shown in table 61. Tires were reported as giving the most trouble by the largest number of these owners. Different parts of motors were reported as giving the most trouble by 69 men, while 35 stated that their greatest trouble had come from some part of the transmission. Of the specific parts of trucks, timers, transmission bands, spark plugs, and gears were reported most frequently as the most troublesome.

TABLE 61. TRUCK PARTS GIVING THE MOST TROUBLE

Truck part	Number of owners reporting the most trouble with this part*
Tires	54
Motor:	
Radiator	6
Carburetor	1
Batteries	3
Magneto	4
Timer	11
Spark plugs	9
Other ignition trouble	7
Connecting rods and bearings	5
Unclassified	23
Transmission:	
Clutch	4
Transmission bands	10
Drive shaft	2
Gears	9
Differential	2
Drive chains	4
Unclassified	4
Steering gear	2
Brakes	7
Lights	1
Unclassified	4
Total number reporting	172

* Sixty-five reported no trouble, 14 did not report.

ADVANTAGES AND DISADVANTAGES OF MOTOR TRUCKS FOR FARMERS

Advantages

The farmers whose survey records were included in this work were asked what they considered to be the chief advantage of a motor truck for farm business. Many different kinds of replies were given, but the majority of the truck owners seemed to consider that the greatest advantage of the farm motor truck is in its ability to save the time of men and horses.

Some men reported that the advantage of a truck lay in its ability to save time on the road; others stated that a truck enabled them to get to

the milk station or the market early enough to be ahead of the crowd and thus avoid long waits. In all, 52 of the 70 farmers who furnished information on this point reported the chief advantage of a truck as some form of a saving of labor.

The next most important advantage was the saving of horses, which was reported as the most important advantage by 16 of the 70 truck owners. This also was reported in various ways, as, "saves horse flesh," "saves grain and hay," "saves driving horses in warm weather," "keeps horses off from state roads," "saves horses' feet and horseshoeing bills." Other advantages of trucks which were reported were that they made available more distant markets, that they enabled their owners to do custom trucking, and that "the boys like to drive them and so stay on the farm."

Disadvantages

The mechanical difficulties experienced by truck owners have been discussed in connection with tables 25 and 61. Few other disadvantages and difficulties were reported. Of the 70 truck owners from whom survey records were taken, 62 reported no disadvantage, 5 reported bad roads, 2 the cost of upkeep, and 1 the temptation to use the truck for pleasure driving, as the greatest disadvantage of a truck to a farmer.

The lack of good roads is probably one of the most serious highway transportation troubles of New York farmers who own motor trucks, and one of the important reasons why more farmers have not bought trucks. Good roads and farm trucks seem to develop side by side. If a farmer has a good road to town he is more likely to buy a truck than if he has a poor road, and if he is on a poor road and has a truck he is very likely to start out to get the good road.

Relative advantages of trucks and tractors

Of 250 truck owners located in various parts of the State, 89 reported that they owned a tractor. Of these, 37 reported that they considered a truck more essential to their farm business than a tractor. The remainder either considered a tractor more essential, or thought both of equal value (table 62).

TABLE 62. REPORT OF 89 FARMERS OWNING BOTH TRUCKS AND TRACTORS ON THE QUESTION, "IS A TRUCK MORE ESSENTIAL TO YOUR FARM BUSINESS THAN A TRACTOR?"

Size of truck owned	Number of owners having this size	Number reporting truck more essential than tractor
½ ton	15	6
¾ ton	3	2
1 ton	39	12
1¼ tons	4	3
1½ tons	12	6
2 tons	12	6
Over 2 tons	4	2
Total	89	37

While the truck and the tractor are designed for entirely different kinds of work, it is of interest to compare the results of this study of farm trucks with some of the results shown by a similar study of farm tractors.[13]

Since the study of tractors was made in 1920 and the present study of trucks was not started until 1921, a comparison of the costs of operation of tractors and trucks based on these two surveys would be misleading because of the wide fluctuation in prices of fuel, labor, and other items of operation which occurred during the period from 1919 to 1921. However, the efficiency of a day's work by a man and a team, or a month of man labor and a year of horse labor, are things little affected by price changes. The average truck displaced 1.8 horses and 4 months of man labor, and the average tractor displaced 2.4 horses and 4.1 months of man labor. The estimated length of useful life of a tractor was 6 years, and of a farm truck 7.4 years. Depreciation is always high on any new kind of machinery, and the tractor came to the farmer as a new and untried machine while the truck had been well tested in other lines of work before it was introduced to the farmer. The farm was the experimental laboratory for testing the tractor, and the farmer paid for the testing when he purchased useless types of machines.

The average two-plow tractor used 12.8 gallons of kerosene and 4.1 gallons of gasoline per ten-hour day, and the average 1-ton truck used one gallon of gasoline for each 9.5 miles driven.

TRUCK OWNERS OWNING PASSENGER AUTOMOBILES

Of 246 truck owners who furnished this information, 185 owned a passenger automobile in addition to a truck. A larger percentage of the owners of the larger trucks had cars, than of owners of the smaller trucks (table 63). The owners of the smaller trucks used them to take the place of a passenger car more than did the owners of the larger trucks.

TABLE 63. NUMBER OF TRUCK OWNERS WHO OWNED PASSENGER AUTOMOBILES

Size of trucks	Number of owners reporting	Number having an automobile	Number not having an automobile
½ ton	63	31	32
¾ ton	14	13	1
1 ton	115	95	20
1¼ tons	5	2	3
1½ tons	24	20	4
2 tons	17	17	0
Over 2 tons	8	7	1
Total	246	185	61

SHOULD A FARMER BUY A TRUCK?

This study was not undertaken to prove that the average farmer of New York should or should not buy a truck. Its purpose was to make

[13] An economic study of farm tractors in New York. By W. I. Myers. Cornell Univ. Agr. Exp. Sta., Bul. 405. 1921.

available, to farmers of the State, information concerning the costs of operating farm motor trucks and their advantages and disadvantages for farmers' use. Whether or not a farmer is justified in buying a truck depends on the answer to two questions. The first is "Will it pay?" and the second, "Is there any better way to invest money that would be spent for a truck?" In deciding whether or not a truck would be a paying investment, the following points should be considered:

1. Present and probable future amount of hauling to be done.
2. Time and value of man and horse labor that a truck would save.
3. The initial cost and the probable operation cost of a suitable truck, as compared with the cost of hauling with horses.
4. The probable length of time during which snow and mud would prevent use of a truck.
5. The probable development of new and improved highways in the section.
6. The possibility of developing new markets by means of a truck.

If after consideration of these points it would appear that a truck would be a good financial investment for the farm business, then the question whether the money that would be spent in purchasing and operating a truck could be used to better advantage elsewhere should be settled.

Conclusions as to effect of farm trucks on general welfare

The farm motor truck is an important factor in increasing the food supply. The use of motor trucks by farmers has made it possible to profitably produce bulky and perishable products at a greater distance from a railroad than could formerly be done. This is especially true of market milk and of fresh fruits and vegetables. Motor trucks have made it possible also for farmers to reach markets that could not be reached at all by any other means. This bringing of more remote land into intensive use, and widening of the farmer's market, means that more food will reach the consuming public and more feed and fertilizer will reach the farm.

The farm motor truck is a cooperator, not a competitor, of the railroad. Only a small part of the truck hauling done by the farmers included in this study actually replaced railroad freighting, since most of it consisted of hauling between the farm and the railroad. Some hauling was done parallel to a railroad; a part of this was in order to reach a more favorable shipping point; a part of it was hauling products that railroads could not have handled; but the greatest part was hauling products that would not have been produced had it not been for the truck.

A limited amount of the hauling which paralleled the railroads was in direct competition with them. A part of this was done, not because it was cheaper than railroad freight, but because it was thereby possible to get a product to market with only one handling instead of several. Probably the principal reason, however, was that it enabled the farmer to get his product thru to market before it spoiled. There is little doubt that the farm motor truck creates more new freight for the railroads than it takes from them.

The number of trucks on farms has greatly increased during the past five years. How much more it will increase will depend on several factors.

Since the truck is a labor-saving machine, if the wages of farm labor are relatively high there will be a tendency for more farmers to use trucks. Better roads also will mean more trucks. Changes in freight rates on farm products, and changes in the relation between the costs of hauling with trucks and with horses, will affect the number of trucks used. The perfection of an automobile motor which could be operated successfully with kerosene or some other low-grade fuel, or the discovery of new supplies of petroleum, would be a decided factor in increasing the number of motor trucks. Furthermore, any increase or decrease in the demand for the more bulky and perishable food products would create a greater or a less demand for trucks to move such products from the more distant farms to the railroads.

Other factors may have some effect on the extent to which New York farmers will use trucks in the future, but the ones given are probably the most important. Basing an opinion on the present and the probable future relation of these factors, the writer expects to see a large increase during the next few years in the number of farm-owned motor trucks in New York.

UNITED STATES DEPARTMENT OF AGRICULTURE. BUREAU OF CROP ESTIMATES
WITH COOPERATION OF
NEW YORK STATE COLLEGE OF AGRICULTURE
DEPARTMENT OF AGRICULTURAL ECONOMICS AND FARM MANAGEMENT
ITHACA, N. Y.

Oct. 15, 1921.

Dear Sir:

In order to make available to farmers of the State information concerning the costs of operating farm motor trucks and their advantages and disadvantages for farmers' use, we are asking farm truck owners to give us the benefit of their experience.

Will you cooperate by filling out the following blank as completely and carefully as possible and returning it in the enclosed envelope, which requires no postage?

Thanking you for your cooperation, we are

Sincerely yours,

J. B. Shepard
Van B. Hart

INFORMATION ON FARM MOTOR TRUCK

Your name_____ P. O. Address_____

Township_____ County_____

How many acres in your farm?_____ What make is your truck?_____

What is its rated capacity?_____ (Tons) What year was it built?_____ Did you buy it new, second-hand, or build out of an auto?_____

How long have you owned it (or used it as a truck)?_____ (Months) If purchased, what did it cost you, including freight?_____

If built on the farm, what did it cost, including auto chassis used, material purchased, and labor of building truck body?_____

How many more years of satisfactory service do you expect from the truck?_____

Over what kind of roads do you usually drive the truck? (Dirt, macadam, brick, etc.)_____

What is your average speed on the road when loaded?_____ (Miles per hour). When empty?_____ (Miles per hour).

Do you use solid tires on front wheels?_____ On rear wheels?_____ Do you use double tires on rear wheels?_____

How many weeks during the past year did snow and mud prevent your using the truck?_____

Please give following information concerning the road hauling **to and from your farm** that you did during the past year with your truck:

ROAD HAULING FOR YOUR FARM DONE WITH TRUCK DURING PAST YEAR					HOW SAME HAULING WOULD BE DONE WITH HORSES AND WAGONS			
Material Hauled	Loads per year	Average weight of loads	Miles per round trip	Hours per round trip	Average weight of loads	Miles per round trip	Hours per round trip	Horses per wagon

For what part of the above hauling did you have return loads (loads both ways)?_____ (OVER)

Please give the following information concerning road hauling done during the past year with horses:

Material Hauled	Loads per year	Average weight of loads	Miles per round trip	Reasons for using horses instead of truck for this hauling

Please give below the hauling on the farm between barns and fields done during the past year with truck:

Material hauled	Loads per year	Average weight of loads	Miles per round trip	Reasons for using truck instead of horses for this hauling

HAULING DONE FOR OTHERS DURING PAST YEAR

Material hauled	Loads per year	Average weight of loads	Miles per round trip	Total dollars received	
				$	How much of the hauling done for others was done while doing some of your own hauling?
				$	
				$	
				$	

In the following table, fill in the acres of crops grown and stock kept on your farm.

Crop	Acres	Crop	Acres	Crop	Acres	Stock	Number of head
Alfalfa		Hay		Bearing pears		Work horses and mules	
Barley		Oats		Other bearing orchard		Cows	
Beans		Peas for canning		Truck crops		Young cattle, and bulls	
Buckwheat		Potatoes				Hogs	
Cabbage		Rye		Any other crops		Sheep	
Corn for grain		Wheat				Poultry	
Corn for silage		Bearing apples				Bees	Hives

How many more horses would you need if you did not have the truck?_____ How many more months of man labor?_____

How far is your farm from your principal market?_____ Have you changed your principal market since you got your truck?_____

If so, how far was it to your former market?_____ If you did not own a truck, would you buy one?_____

What size would you get?_____ (tons). What make?_____ Who usually drives your truck?_____
(Yourself, son, hiredman, etc.)

Have you had to hire special help for driving the truck?_____ If so, how much per month above the wages of regular farm labor do you pay such help?_____ What part of the truck has given you the most trouble?_____

How many days during the past year was the truck laid up for repairs when you needed it?_____ Have you an auto?_____

Did you have one before you got a truck?_____ Have you a tractor?_____ Did you have one before you got a truck?_____

Is a truck more essential to your farm business than a tractor?_____ How many miles was your truck driven during the past year?_____

How many miles of this was for pleasure or passenger use (truck used in place of pleasure car or driving horse)?_____

Give the following information concerning any other farm trucks that you have owned:

Make	Size	Cost	Years used	When sold or discarded	Price received	Reasons for selling or discarding

FARM MOTOR TRUCK RECORD

Prepared By

New York State College of Agriculture
Department of Agricultural Economics and Farm Management
Cornell University, Ithaca, N. Y.

Record for year ending_____19____ Date_____19____ Record Number_____ Tabulation Number_____

Farm Operator_____ P. O. Address_____ County_____

Distance to principal market_____miles. Has it been changed since getting truck?_____ Miles to former market_____

Have new secondary markets been developed by means of the truck?_____ Distance to these markets_____

Acres owned_____ Acres rented_____ Total acres_____ Value of farm $_____ Value per acre $_____

Make of truck_____ Rated capacity in tons_____ Year built_____

Has truck solid or pneumatic tires in front?_____ On rear?_____ Has it single or dual tires on rear?_____

Was truck bought new, second hand or built on the farm?_____ Months owned or used as truck by present owner_____

Cost if purchased $_____ Cost if built on farm $_____ Value at beginning of year $_____ Value at end of year $_____

Average value $_____ Additional years of satisfactory service expected_____ Estimated junk value when discarded $_____

TRUCK COSTS		
Depreciation	$ X	$
Interest on average value at 6%	X	
Insurance	X	X
Fire		X
Theft		X
Casualty		X
Collision		X
Total	X	
License	X	
Repairs and new parts	X	X
Inner tubes new $ repair $		X
Pneumatic casings new $ repair $		X
Solid tires new $ repair $		X
Batteries		X
Spark plugs		X
Radiator		X
Gears		X
Brakes		X
Body		X
Other cash repairs		X
Total cash repairs		X
Farm labor on repairs hrs. at $		X
Total repairs	X	
Fuel	X	X
Gasoline gal. at $		X
Kerosene gal. at $		X
Total	X	
Lubrication	X	X
Motor oil gal. at $		X
Cupgrease lbs. at $		X
Transmission grease lbs. at $		X
Total	X	
Use of building at 10% of $	X	
Garage storage	X	
Other costs	X	
Total cost aside from driver	X	$

TRUCK DRIVER	
Per cent of time driven by owner %, by son %	
by hired help %, by others %	
HIRED DRIVER	
Months hired Hours worked per month	
Total wages paid	$
Value board furnished	
Value of other farm products and privileges	
Insurance on driver	
Driver's license	
Total	$
Cost for ordinary farm work	
Extra cost because of truck	
Cost per month for ordinary work $ per hr.	
Extra cost per hour of truck driver (hrs.)	
Total cost per hour of driver	
UNPAID DRIVER	
Months worked Hours worked per month	
Cost to hire	
Value of board furnished	
Value of other farm products and privileges	
Insurance on driver	
Driver's license	
Total	
Cost for ordinary farm work	
Extra cost because of truck	
Cost per month for ordinary work $ per hr	
Extra cost per hour of truck driver (hrs.)	
Total cost per hour of Driver	
SUMMARY	
Total cost of operating truck	$
Total miles traveled during past year	
Truck cost per mile run	$
Cost of driver hrs. at $	
Cost of driver per mile run	
Total cost per mile run	
Total ton miles	
Cost per ton mile of truck	$
Cost per ton mile of driver	
Total cost per ton mile	
Average length of haul	miles
Average weight of load	lbs.

What is average speed of truck on dirt road when loaded?_____ When empty?_____

On hard surfaced roads when loaded?_____ When empty?_____

Days during the past year truck was laid up for repairs when needed?_____

What part has given the most trouble?_____

Weeks during the past year that snow and mud prevented using the truck?_____

If you did not have a truck would you buy one?_____ What make would you get?_____ What size?_____ Tons capacity_____

Have you an auto?_____ Did you have one before getting a truck?_____ Have you a tractor?_____ Did you have one before getting a truck_____

Is a truck more essential to your farm business than a tractor?_____ Could you handle your present farm business without a truck?_____

How many more horses would you need if you did not have a truck?_____ How many more months of man labor?_____

What do you consider the chief advantages of a truck?_____ The chief disadvantages?_____

ROAD HAULING FOR THIS FARM DONE WITH TRUCK DURING THE PAST YEAR

Material Hauled	Kind of Roads	Total Loads	Average Weight of Loads	Miles per Round Trip	Hours Driving per Round Trip	Hours Loading and Unloading per Trip	Percent of Time having Return Loads	Total Hours	Ton Miles

HOW SAME HAULING WOULD BE DONE WITH HORSES AND WAGONS

Average Weight of Loads	Miles Per Round Trip	Hours Per Round Trip	Horses Per Wagon

TRUCK HAULING ON THIS FARM DONE BETWEEN BARN AND FIELDS DURING THE PAST YEAR

Material Hauled	Kind of Roads	Total Loads	Average Weight of Loads	Miles Per Round Trip	Hours Driving Per Round Trip	Hours loading and Unloading per Trip	Percent of Time having Return Loads	Total Hours	Ton Miles

REASONS FOR USING TRUCK INSTEAD OF HORSES FOR THIS HAULING

CUSTOM HAULING DONE WITH TRUCK DURING THE PAST YEAR

Material Hauled	Kind of Roads	Total Loads	Average Weight of Loads	Miles per Round Trip	Hours Driving Per Round Trip	Hours Loading and Unloading per Trip	Percent of Time having Return Loads	Total Hours	Ton Miles	Total Dollars Received

How much of the custom hauling was done while doing some of your own hauling?

ROAD HAULING FOR THIS FARM DONE WITH HORSES DURING THE PAST YEAR

Material Hauled	Kind of Roads	Total Loads	Average Weight of Loads	Miles per Round Trip	Hours Driving Per Round Trip	Hours Loading and Unloading per Trip	Percent of Time having Return Loads	Total Hours	Ton Miles

Reasons for Using Horses Instead of Truck for This Hauling

CROPS AND STOCK ON THIS FARM

Crop	Acres	Crop	Acres	Crop	Acres
Alfalfa		Hay		Bearing pears	
Barley		Oats		Other bearing orchard	
Beans		Peas for canning		Truck crops	
Buckwheat		Potatoes			
Cabbage		Rye		Any other crops	
Corn for grain		Wheat			
Corn for silage		Bearing apples			

Stock	Number of Head
Work horses and mules	
Cows	
Young cattle and bulls	
Hogs	
Sheep	
Poultry	
Bees	Hives

INFORMATION CONCERNING TRUCKS PREVIOUSLY OWNED

Make	Size	Cost	Year Used	When Sold or Discarded	Price Received	Reason for Selling or Discarding